SUTTON AND EAST SURREY WATER PLC

Climate Change Adaptation Report

EXECUTIVE SUMMARY

1. Information on the Organisation	
Name of Organisation	Sutton & East Surrey Water
Organisation functions, missions, aims and effective objectives affected by the impacts of climate change	We are a public water supply company based in the South East of England Our key aim, as set out in our PR2009 Business Plan, is to achieve the best balance of outputs, investment and prices that will: • Meet customers' overwhelming requirements for adequate, reliable supplies of high quality water. • Provide greater resilience to help withstand the challenges of climate change, and reduce our impact on the environment. • Provide customers with a high level of service that represents fair and reasonable value for money • Carry out our operations in an environmentally friendly and sustainable way • Maintain an adequate return to enable us to finance our functions Climate change is explicitly recognised within our key aim because it has the potential to affect all areas of the business.
2. Business Preparedness before Direction to report was issued	
Has your organisation previously assessed the risks from climate change?	Yes. We have carried out assessments on the effects of climate change on water resources in our supply area and the potential effects of flooding on our assets. These have fed into our Business Plan which includes a number of deliverable items over the current business regulatory cycle (2010 to 2015) and our strategic direction for the next 25 years.
3. Identifying the risks due to impacts of climate change	
What evidence, methods, expertise and level of investment have been used when investigating the potential impacts of climate change?	For this report we have used in-house personnel to carry out a high level risk assessment using water industry standard tools and information gathered from UKCP09. We have then used reports which have been written to explain how we assess these risks in detail. These reports are based on the UKCIP02 model, water industry research, published flood data and accepted prediction tools e.g. CATCHMOD.

4. Assessing the risks	
How does your organisation quantify the impact and likelihood of risks occurring	We have carried out a high level study using a risk assessment approach that considers the likelihood of an event occurring and the consequence of that event on the Company. Scenarios for the assessment were obtained from previous published work for the water industry. This study shows where we will have to carry out more detailed work. Medium and high risks are examined in greater detail using reports previously commissioned by the Company (e.g. on Water Resources and Flooding). Low and residual risks are discussed and the Company's existing resilience to these risks considered.
5. Uncertainties and Assumptions	
What uncertainties have been identified in evaluating the risks due to climate change?	There are a number of assumptions in our work, which due to the time period for climate change need to be pointed out. These are: • The water industry will exist in its current form with the same regulators and regulatory regime. • We will continue to provide the same level of service to our customers. • Increases in population and property will be in accordance with our Business Plan and Water Resources Management Plan forecasts. • Other authorities and utilities will be adapting to climate change, so that loss of service from their activities is limited to a maximum of 48 hours. There are also a number of uncertainties in the methodology that we employed. These were: • Our detailed analysis is based on UKCIP02 model and not the latest UKCP09 model. • We have used the Environment Agency's flood maps for the risk screening exercise. These only consider historic climate change and do not consider flooding from other sources. Although we have made allowance for this, there is still a margin of uncertainty in the outcomes.

6. Addressing current and future risks due to climate change – summary

Business function	Climate variable	Primary impact of climate change	Threshold above which this will effect your organisation	Likelihood of threshold being exceeded in the future and confidence of assessment	Potential impacts on organisation and stakeholders	Proposed Action to mitigate	Timescale over which risks are expected to materialise and action is planned.
Water Resource	High Summer Temperatures	Higher demand for water. Greater evaporation from surface sources. Higher soil moisture deficit at the end of the summer.	Water available for use to meet average demand in a dry year is 201 Ml/d. Water available for use to meet peak week demands in a dry year is 269 Ml/d	Highly likely over the next 25 years due to forecast growth in demand and the effects of climate change. We already have a deficit in resources to meet peak demands.	No impact on Company provided forecasts within the Water Resources Management Plan are of the right order and mitigation measures are funded and followed. Company will continue to operate within stated Levels of Service. Stakeholders will be expected to play their part by reducing consumption.	Increase in demand management including increased customer metering and water efficiency measures, and leakage reduction. Resource development to ensure resources available to meet peak demands.	Risks will emerge gradually in accordance with UKCP09 climate change predictions. The Company is currently taking action to address the peak deficit, but will not be able to meet peak demands fully until it has been funded in accordance with its Water Resources Management Plan. Expected 2018.
Water Resource	Lower Summer precipitation	Higher demand for water for gardening purposes. Reduced aquifer recharge.					
Water Resource	Higher winter precipitation	More available surface water, during winter months. Aquifer recharge will depend on the effect of increased summer temperatures on soil moisture deficit.	No threshold. This is a positive impact and any increase in river flows is welcomed. Uncertain what the effect may be on diffuse pollution.	Impounding reservoir, except during extreme years, is full by end of January. Potential three months of additional pumping available if flow-rate out of treatment works can be increased, and distribution system enhanced.	Increase in available resources from rivers. However, the opportunity for greater strategic use of resources may result in an increase in energy use linked to the increase in distribution pumping.	Planned increase in water treatment capacity linked to 25 Ml/d increase in output from reservoir.	Originally planned to be done over the next five years. First phase complete. Second phase commenced. Third phase planned for 2015 to 2018 subject to funding at next Periodic Review.

6. Addressing current and future risks due to climate change – summary

Business function	Climate variable	Primary impact of climate change	Threshold above which this will effect your organisation	Likelihood of threshold being exceeded in the future and confidence of assessment	Potential impacts on organisation and stakeholders	Proposed Action to mitigate	Timescale over which risks are expected to materialise and action is planned.
Flooding of Assets	Higher winter precipitation	Flooding of assets could cause loss of supply to our customers.	1 in 200 year flood event resilience from 2015 for all but one of our sites.	1 in 200 year risk of threshold being exceeded. Greater confidence with regard to fluvial flooding. Less confidence in respect of pluvial and other forms of flooding.	Loss of supply to our customers.	Increase in flood defences to ensure assets are protected from a 1 in 200 year flood event.	Additional flood defences being installed at two of our treatment works over the next five years. Funding will be sought at the next Periodic Review for site rejected by regulator in the current business cycle.
Raw Water Quality	Higher summer temperatures	Potential for algal growth in surface water reservoir. Potential for changes in land use and diffuse pollution.	Regular growths of algae involving manual intervention. Breaches of water quality PCVs	Unknown. Adaptive response can be retrofitted in short time if funding is available. Unknown	Large algal growth would effect leisure users of reservoir and challenge our treatment processes leading to a greater cost in treating the water. Increased diffuse pollution would require additional water treatment processes.	Installation of new equipment or water treatment facilities	Unknown. Existing equipment already in place. Some algal growth experienced in 2010 during Autumn period. Wait and see approach adopted by company. Unknown
Treatment and Distribution of Water	Higher summer temperatures	Overheating of equipment	Average temperature of 35 deg C over 24 hours.		Short term inability to pump water.	Assets have a life of 25 years. We expect that changing engineering standards will ensure that assets will cope with climate change.	Action is part of normal replacement cycle for equipment.

6. Addressing current and future risks due to climate change – summary

Business function	Climate variable	Primary impact of climate change	Threshold above which this will effect your organisation	Likelihood of threshold being exceeded in the future and confidence of assessment	Potential impacts on organisation and stakeholders	Proposed Action to mitigate	Timescale over which risks are expected to materialise and action is planned.
Treatment and Distribution of Water	Higher summer temperatures or extreme weather events	Failure of grid electricity.	Power failure in excess of 48 hours.	Unknown. Dependent on third party adaptive response.	Short term inconvenience for treatment works and pumping stations.	Research into low power data transmission systems used in smart meter technology.	Existing resilience in place.
Treatment and Distribution of Water	More frequent extreme weather events	Failure of Road Network	Failure in excess of 48 hours	Unknown. Dependent on third party adaptive response.	Operation becomes difficult. Chemical deliveries delayed leading to difficulty in treating water.	Existing resilience in place. Operational staff have access to four wheel drive vehicles. Minimum of two weeks worth of chemical stocks at treatment works.	Existing resilience in place.
Customer Service					Customer service staff unable to get to work and respond to customers issues	Travel distance may need to be considered when recruiting new staff in the future.	We will be monitoring the recent colder winters to determine whether it is a long term effect of climate change or natural variance.
Customer Service	Higher summer temperatures or extreme weather events	Failure of telecommunications network	Telecommunications failure in excess of 48 hours.	Unknown. Dependent on third party adaptive response.	Customers unable to report problems. Potential impact on the response time to deal with incidents.	Existing equipment in place that monitors for major bursts etc… Unable to help customers when we can not receive their calls or they are unable to call us.	50-100 years

6. Addressing current and future risks due to climate change – summary

Business function	Climate variable	Primary impact of climate change	Threshold above which this will effect your organisation	Likelihood of threshold being exceeded in the future and confidence of assessment	Potential impacts on organisation and stakeholders	Proposed Action to mitigate	Timescale over which risks are expected to materialise and action is planned.
Storage of water	Extreme event (drought)	Failure of earth-fill embankment impounding reservoir	Unknown	Probability of failure in short to medium term is very low.	In worst case, failure of dam leads to downstream flooding, loss of life and long term loss of raw water resource.	We are working with the Panel Engineer for the dam to determine potential effects and required action to ensure that climate change does not affect impounding reservoir.	We expect effects, if any, to materialise over the next 50-100 years.

7. Barriers to implementing the adaptation programme

What are the main barriers to implementing adaptive action?	We identified the following main barriers to our adaptive response: **Investment**. A key barrier is the cost of adapting to, or mitigating against, the effects of climate change, and who pays those costs and when. For example, at the PR2009 price review, Ofwat refused to fund water resources expenditure without supporting evidence based on UKCP09 scenarios. At that stage all water company work was based on UKCIP02 scenarios. **Public Understanding**. Public understanding for the need to adapt to climate change is important since ultimately it is the public that will be paying for the adaptation measures. As a Company we are trying to change customers' behaviour with regard to the use of water. This is an adaptive response since it responds to potential reduction in available resources. **Interpretation of UKCP09 data**. Work is currently being undertaken by UKWIR and the EA to interpret the effects of the latest climate change model on the water industry. Existing research is based on the UKCIP02 model. We expect this barrier to adaptation to be short term. **Third party adaption**. We are reliant on information from other companies to understand and adapt to the risks that their systems present. An example of this is the lack of pluvial flooding data. Without this data we do not know to what extent our assets are at risk from a flooding event in the future. We have overcome this by using anecdotal evidence. We also need to understand how other companies and infrastructure providers will be adapting to gauge the level of resilience that we need to provide. If other infrastructure providers (e.g. electricity) are adapting and can maintain the same level of service as currently experienced then the amount of extra resilience we have to provide can be reduced.

8. Report and review	
How will the outcome of the adaptation programme be monitored and evaluated and what is the timetable for this?	The water industry is heavily regulated and we are obliged to report to our regulator on how we are adapting to, and mitigating against, climate change. This helps to ensure that climate change is firmly embedded within our company. We routinely, in some cases daily, monitor variables that are directly affected by climate change. This gives us a good supply of historic information that provides justification for our adaptive response. High risk issues such as water resources and flooding have clear plans in place which look forward to the next 25 years. For residual risks we rely on water industry research and forums to keep abreast of current best practice. A wait and see approach has been adopted within our plans for the residual risks and those risks where adaptive measures can be completed in a short time.
9. Recognising Opportunities	
What opportunities due to the effects of climate change and which the organisation can exploit have been identified?	The predicted increase in winter precipitation facilitates the following opportunities: • More water available for abstraction during winter months from surface water sources (can be used to allow boreholes to rest and recharge provided there is sufficient flexibility in the distribution system). • Increased potential for aquifer recharge during winter months (can be used for meeting peak demands in the spring and summer). • Increased potential for additional bank-side storage. The reduction in summer precipitation leads us to believe that there is the potential to use more solar power in the future especially as the maximum production in electricity coincides with the maximum demand for water. As public awareness of the effects of climate change increases, it should become easier to influence behaviour in respect of water use. Reducing the consumption of water is a key step in adapting to the changes that are likely to occur as a consequence of climate change.

10. Further comments / information	
Do you have any further comments which would inform Defra?	It is important to recognise the role Government has to play in adapting to climate change. Strong leadership and a commitment to leading by example, and making any necessary legislative changes are a key part of the picture. Education of, and assistance to businesses and the general public will be required if we are going to reduce the use of water. Water companies will play their part by reducing leakage, promoting water efficiency and installing meters, but demand management is not cheap (and not necessarily the most cost beneficial solution to resolving a supply/demand balance problem), but should be part of a twin track approach. Therefore Government and the Regulators need to be supportive and help promote behavioural change, and ensure that water company revenue is sufficient to be able to put these measures in place. We all have a part to play, and promoting joint research into understanding and adapting to climate change and its effects will be a far better use of public money than requiring each water company to carry out its own research.

AMENDMENT CONTROL RECORD

Section	Page	Issue	Date	Comments	Approved By
ALL	ALL	1	23/12/10	First complete draft issue	N/A
ALL	ALL	2	14/01/11	Incorporate comments	N/A
ALL	ALL	3	26/01/11	Incorporate comments	N/A
ALL	ALL	4	28/01/11	Incorporate comments	N/A
ALL	ALL	5	28/01/11	Incorporate comments	N/A
ALL	ALL	6	31/01/11	First Issue to Defra	LS

CONTENTS

SECTION 1.0

INTRODUCTION

1. Introduction

1.1. Overview

This document responds to the direction from the Secretary of State for a report under the Climate Change Act 2008. A copy of the direction can be found in appendix A.

In compiling this report we have followed the advice contained within the statutory guidance issued by DEFRA and the supplementary guidance issued by the Environment Agency.

It should be noted that Sutton and East Surrey Water has a number of regulatory reporting requirements. In line with clause 1.12 of the statutory guidance we have tried to compile those reports into this Climate Change Adaptation Report.

1.2. Company background

Sutton and East Surrey Water is a water only supply Company in the south east of England serving a population of approximately 650,000 people. The supply area is 322 square miles (834 sq km) extending from Morden and South Croydon in the north to Gatwick Airport in the south and from Cobham, Leatherhead and Dorking in the west to Edenbridge and Bough Beech in the east.

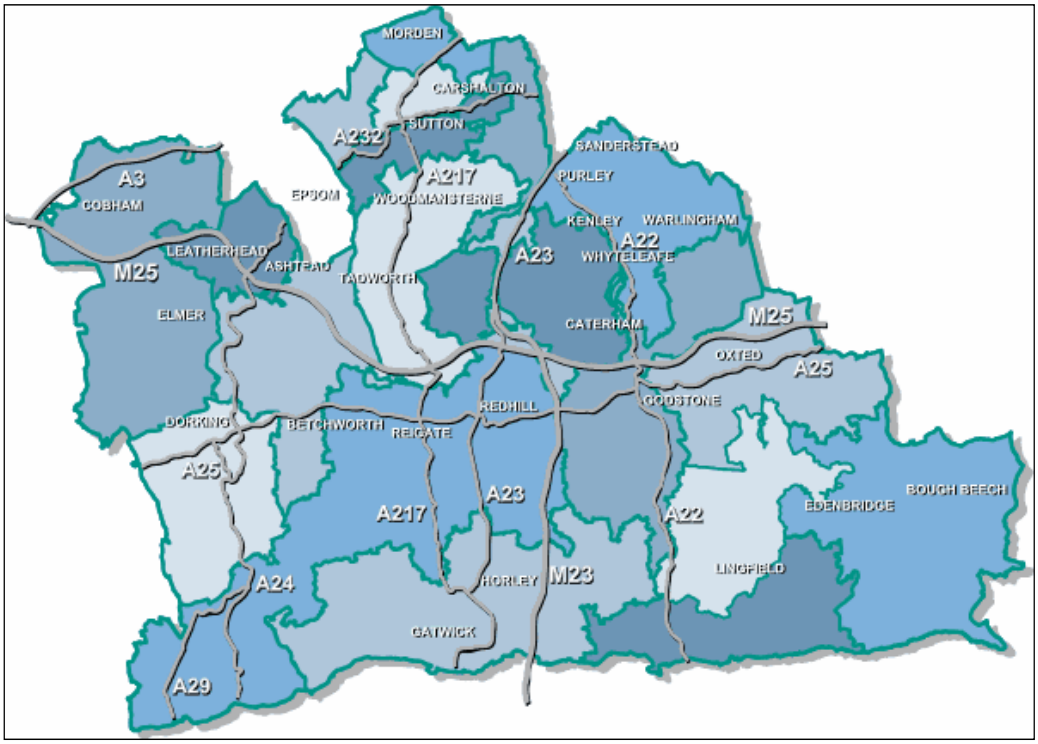


Figure 1.1: Extent of SESW Water Supply Area

Sutton and East Surrey's Water is supplied from ground water boreholes (85%) and the river Eden (15%) in the east of the Company's supply zone. There are two rivers, the Eden and the Mole, and a number of chalk streams (including the Wandle) within the Company's area.

The company is located within an area (see figure 2) which is "seriously water-stressed" according to the Environment Agency's methodology which looks at where:

- the current household demand for water is a high proportion of the current effective rainfall which is available to meet that demand; or
- the future household demand for water is likely to be a high proportion of the effective rainfall which is likely to be available to meet that demand.

Source: *"(http://publications.environment-agency.gov.uk/pdf/GEHO1207BNOC-e-e.pdf)*".

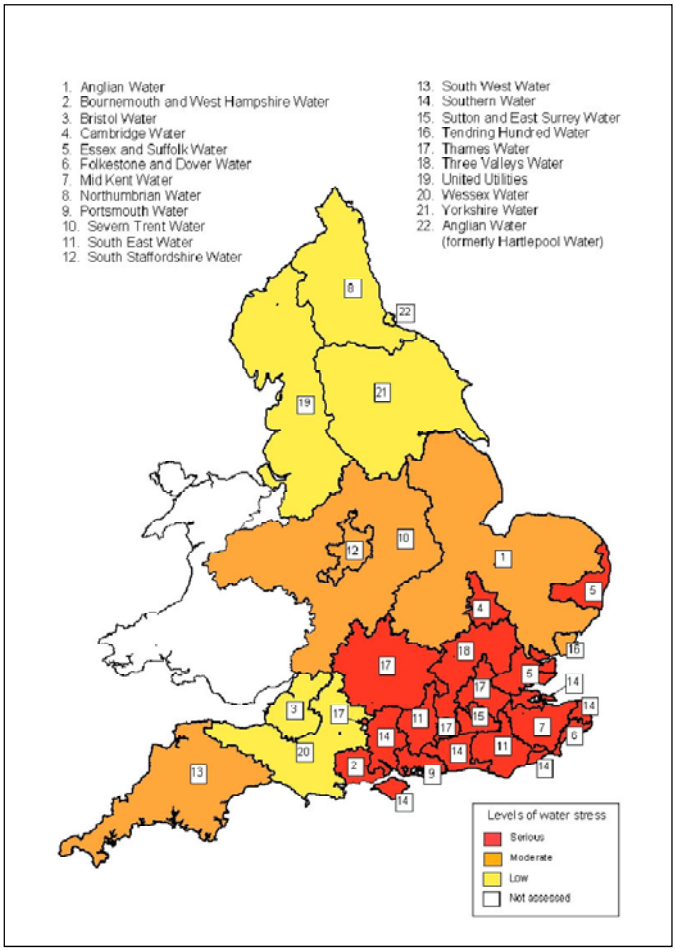


Figure 2: Areas of water stress within England.

1.3. Strategic aims

Our key aim, as set out in our PR2009 Business Plan, is to achieve the best balance of outputs, investment and prices that will:

- Meet customers' overwhelming requirements for adequate, reliable supplies of high quality water.
- Provide greater resilience to help withstand the challenges of climate change, and reduce our impact on the environment.
- Provide customers with a high level of service that represents fair and reasonable value for money
- Carry out our operations in an environmentally friendly and sustainable way
- Maintain an adequate return to enable us to finance our functions

Climate change is explicitly recognised within our key aim because it has the potential to affect all areas of the business.

1.4. Regulatory structure

Sutton and East Surrey Water sit within the UK water regulatory structure. There are three main regulators within this structure. They are:

- Water Services Regulation Authority (OFWAT)
- Drinking Water Inspectorate (DWi)
- Environment Agency (EA)

Sutton and East Surrey Water has to produce a Business Plan every five years that sets out what work that will be undertaken over the next five years along with the prices we need to charge our customers. This Business Plan is analysed by OFWAT. OFWAT's "job", as set out on their website, is to make sure that we provide our customers with a good quality service at a fair price. They do this by:

- keeping bills for consumers as low as possible
- monitoring and comparing the services the water companies provide
- scrutinising water companies' costs and investment
- encouraging competition where this benefits consumers.

Ofwat protects the interests of water company customers by incentivising efficiency and rewarding high service standards.

OFWAT also requires the Company to report on an annual basis (the "June Return") on its performance against a number of outputs. These include:

- water resources
- water quality
- customer service
- leakage rates
- delivery of capital projects (including adaptation measures)
- greenhouse gas emissions.

The DWi is responsible for ensuring that the Company provides wholesome water to its customers. The DWi's website sets out the following roles for the regulator:

- provides independent scrutiny of water company activities for companies supplying drinking water in England and Wales
- works with other stakeholders for the improvement of drinking water quality and to secure drinking water safety
- commissions research to build a sound evidence base for drinking water quality
- publishes data on drinking water quality in England and Wales.

If the Company fails to provide wholesome water the DWi has the power to prosecute.

The standards imposed by the DWi have an effect on the capital and operational budgets of the Company and therefore make up a proportion of the Company's Business Plan submissions to OFWAT.

The EA is responsible for licensing and monitoring the water that the Company abstracts from the ground or from its river source. The Company works with the EA to agree what can be abstracted from the various water sources without damaging the environment. There are competing demands on water and in a number of places the Company has to send a compensation flow to local streams. The Company has to pay the EA for the right to abstract water and this forms part of its Business Plan submissions.

Disposal of the wastes that the Company produces are regulated by the EA. These include any of the minerals removed from water as part of the treatment process (clay, calcium carbonate etc.) and any water which cannot be used for public water supply, e.g. the water run to waste when a borehole is started up from a rest position, and the water used for flushing of treated water mains.

1.5. Current resilience

Climate change is one of many risks that the Company faces. The Company is obliged to develop a reasonable level of resilience to all of these risks.

For example, it would be unacceptable for our customers to go without water for a prolonged period of time if we were to lose electrical power. To mitigate this risk, the Company has installed standby generation plant at its treatment works and pumping stations. It also has mobile generation plant that it can send to its smaller sites as and when required.

The Company supplies an area which has high consumption per property at times of peak and average demand. We have therefore invested heavily in the development of new resources and in demand management (e.g. leakage reduction). We have also invested in schemes (such as aquifer recharge) specifically aimed at meeting peak demands where we have a deficit in resources.

1.6. Confidentiality

The names and locations of the company's assets have been anonymised to protect the security of the installations.

SECTION 2.0

IDENTIFYING THE RISKS

2. Identifying the risks

2.1. Introduction

This section considers the specific risks to Sutton and East Surrey Water from climate change. It uses UKCP09 to give a broad indication as to the effect of climate change on Sutton & East Surrey Water over the next 100 years. An industry standard risk assessment is then used and modified to make it specific to the risks facing Sutton & East Surrey Water. The risks are then categorised and dealt with in more detail in later sections of this report.

2.2. Risk assessment

In 2007, the water industry trade body, Water UK, commissioned research into the likely effect of climate change on the UK Water Industry. The title of this assessment is "*Water UK – A Climate Change Adaptation Approach for Asset Management Planning v 1.0 (November 2007)".*

The study detailed all the problems faced by the water industry and was not Company specific. For instance, Sutton & East Surrey Water does not directly face issues to do with sewage and our area of operations is some distance from the coast.

Sutton & East Surrey Water has used this initial framework as a basis for the assessment of the areas that require further development.

2.3. UKCP09

The United Kingdom Climate Change Predictions 2009 were used as part of the initial assessment of the climate change impacts on the Company. The outputs give the Company a broad indication of how the climate is likely to change over the next 100 years.

The Company is specifically interested in the answers to the following questions:

- How will precipitation levels change?
- Will there be any change in precipitation between Winter and Summer?
- How will temperature change?
- Will there be an increase in the maximum temperature?

The answers to these questions influence the likelihood of particular events happening.

These questions were inputted into DEFRA's UKCP09 website (http://ukcp09.defra.gov.uk/); the results of this can be seen in Appendix A. We chose the medium emissions scenario since we believe that curtailment of emissions will become the acceptable business standard.

In summary the following results were obtained:

- winters will be warmer but wetter than they currently are
- summers will be drier and warmer.

Given the uncertainty associated with the predictions no further analysis was carried out. We have also assumed that that although the number of extreme weather events may increase, but their severity will not.

Over the next five years the Company will update its climate change forecasts using the interpretation of UKCP09 currently being carried out by the EA and UKWIR. This information will feed through into the specific risks that have been identified.

2.4. Evaluation process

2.4.1. General

Sutton and East Surrey Water carried out a risk assessment which looked at the likelihood of an event happening, the consequence of that event happening, and also how concerned the public would be. Evaluation of these three areas gives a risk score which influences what further action the company needs to take. An explanation of the criteria used in each of these three categories is given below.

2.4.2. Likelihood

The likelihood of an event happening at Sutton and East Surrey Water sites was evaluated. The following scoring was then used in the risk assessment:

Score	Description
1	Very low probability of this happening at Sutton and East Surrey Water
2	Low probability of this happening at Sutton and East Surrey Water
3	Medium probability of this happening at Sutton and East Surrey Water
4	High probability of this happening at Sutton and East Surrey Water
5	Very high probability of this happening at Sutton and East Surrey Water.

2.4.3. Consequence

The likelihood of each event considered affecting the Company's ability to supply water to its customers was then scored on the following basis:

Score	Description
1	No impact on Company's infrastructure or resources
2	Minimal impact. Issue can be dealt with by utilising additional resources.
3	Medium impact. Required action covered by the emergency procedures manual.
4	High impact. Significant costs or large number of customers affected.
5	Major impact on Company's ability to supply water to customers.

2.4.4. Public concern

Likelihood and consequence take no account of public concern. Public concern over a potential issue may bear no relation to the actual likelihood or consequence of the event happening and hence risk of the event.

For a Company directly serving the public, the effect of adverse public and hence media attention may drive greater resources to be deployed than may otherwise be necessary. Conversely lack of knowledge of the likelihood and consequence may make the public question why resources have been allocated to an issue.

Public concern has been weighted using the following criteria:

Score	Description
1	No public concern.
2	Some concern by public. Press release issued.
3	Localised public concern. Local press involved. Regulator informed
4	Significant public concern. National press involved. Significant regulatory supervision by one or more regulators
5	Significant public outrage. Public inquiry into incident called

2.4.5. Evaluation of risk (scoring)

Risk to the Company was evaluated by multiplying likelihood, consequence and public concern to give a score. Depending on the result of the score indicates whether further more detailed evaluation has been carried out to determine the specific issues.

The table below gives the criteria used to determine what further action should be taken:

Scoring	Rating	Response
64 to 125	Very High	Detailed analysis and plans required. Implementation of plans to start within the short term if not already started.
32 to 63	High	Detailed analysis and plans required. Consideration given to the implementation of plans in the short/medium term.
16 to 31	Medium	Consideration given to detailed analysis of risk and production of action plans.
8 to 15	Low	Review of existing Company procedures to determine whether risk is covered.
1 to 7	Very Low	Kept under review

All risks identified whether, very low or very high, will be reviewed as part of the Company's five yearly Business Plan.

2.5. Results of risk assessment

The results of the risk assessment can be found in appendix B. These show that the following categories have a scoring in the medium, high or very high category:

- *Water Resource Management.* All the high and very high risks are to do with water resources.
- *Flooding*. Flooding was mainly perceived as a medium risk. However hidden within the global Company view are specific areas of concern and therefore this area has been dealt with in detail.
- *Infrastructure*. This considers the risk from failure of other utilities infrastructure and its impact on Sutton & East Surrey Water. These were considered a medium risk

There were also a number of risks that could not easily be categorised. None of these risks had a risk rating higher than Medium, with the majority in the Low and Very Low areas. These risks have been commented upon and where necessary are expanded upon in section 3.4 of this report.

2.6. Conclusion

To summarise, the main effects of climate change on our business are:

- changes to water resources both from a reduction in available supply and an increase in demand
- the potential for increased flooding due to climate change
- the effect of loss of other utilities services (power, communications etc.) to our sites.

Our assessment of these risks is consistent with DEFRA's recent commissioned report *Adapting Energy, Transport and Water Infrastructure to the Long-term Impacts of Climate Change* (URS Corporation – January 2010).

SECTION 3.0

DETAILED EVALUATION

AND PROPOSED ACTIONS

TO ADDRESS IDENTIFIED RISKS

3. Detailed evaluation and proposed actions to address identified risks

3.1. Water resources planning

3.1.1. Introduction

The risk identification exercise (see section 2.0) identified water resources as the highest area of risk for the Company from climate change. How the Company responds and reports on water resources is covered by statute law.

In accordance with regulation 6 of the Water Resources Management Plan Regulations 2007 and the Water Industry Act 1991, Sutton and East Surrey Water developed a Water Resources Management Plan (WRMP) which covers the period from 2007/08 to 2034/35. Our plan includes an assessment of the effect of climate change on resources (groundwater and surface water) and demand. A copy of the WRMP can be found on our website (see attached references list).

The WRMP sets out our water resources strategy until 2034/05 including our response to the effects of climate change. This section includes extracts from pertinent areas of the WRMP and the methodology used for dealing with climate change. It discusses the effect of climate change on water resources and demand and then discusses how the Company is responding to these pressures. Finally it states how we intend to keep these plans under review.

3.1.2. Background

Sutton and East Surrey's water resources are predominately from ground water sources, either in the Chalk or Lower Greensand. These sources currently make up 85% of the Company's supply of water. The other 15% is from the River Eden where the Company has a license to abstract from September to April each year.

The Company's stated levels of service set out in its Business Plan, and Water Resources Management Plan are as follows:

"The Company will ensure that sufficient resources are available so that:

- A hosepipe ban will only be required when there is a 1 in 10 year drought.
- Restrictions on the non-essential use of water will only be required when there is a 1 in 20 year drought.
- Rota cuts, or the use of standpipes, will only be required in the most extreme drought or emergency situations."

In 2005/06 the Company had a hosepipe ban and a ban on the non-essential use of water.

The company is located within an area which is "seriously water-stressed" according to the Environment Agency's methodology which looks at where:

- the current household demand for water is a high proportion of the current effective rainfall which is available to meet that demand; or
- the future household demand for water is likely to be a high proportion of the effective rainfall which is likely to be available to meet that demand.

The Company's Water Resources Management Plan sets out how it will ensure that there are sufficient resource available for it to supply customers in accordance with its stated Levels of Service taking into account its water stressed status.

3.1.3. Method for determining the effect of climate change on groundwater sources

The potential impact of climate change on the 1 in 50 year source deployable outputs has been investigated in accordance with the UKWIR/EA guidance 06/CL/04/08 (UKWIR/EA, 2007). This has been undertaken by investigating the impact of climate change on the Well House Inn Chalk signature borehole to 2020. This has been done using the Environment Agency's CATCHMOD groundwater level predictor model for this observation borehole, and then scaling this impact to the abstraction sources in exactly the same way as undertaken in the scaling operation used for calculating the 1 in 50 year drought annual minimum water level. Full details of the approach taken are set out within the technical report, "2007 Reassessment of Groundwater Source Deployable Outputs", ref: 5030095/DG/70/109)".

Wet, dry and average climate change scenarios have been derived based on the minimum, mean and maximum CATCHMOD outputs (which were obtained from perturbed input rainfall and PET series) for each UKWIR06 model scenario. Minimum, mean and maximum values of deployable output were derived for each groundwater source and then applied in the Headroom model using a triangular distribution.

3.1.4. Method for determining the effect of climate change on surface water resources

The adopted methodology for assessing the impact of climate change on the surface water deployable output for Reservoir A was based on the findings of the UKWIR CL/04/C project 2005, consistent with the recommendations of the EA Water Resources Planning Guideline. The source river was assessed using the RR1 method. This is the simplest of the rainfall-runoff methods and involves using rainfall and PET factors from several climate models. These factors were used to perturb historic climate data, with the resulting series then run through a CATCHMOD model. Long-term records of rainfall and PET were established for the river catchment using standard hindcasting and spatial interpolation approaches. This has yielded rainfall back to 1888 (daily) and PET back to 1880 (mainly daily but monthly during 1880-1933, 1945-1946).

Overall this provides a consistent record of baseline climate data from 1888 onwards, with a nominal end date of 1990 (after which it is commonly assumed that climate change can affect the record). Future climate series have been produced by multiplying the rainfall and PET factors by the baseline record.

The latest fully calibrated and validated version of CATCHMOD was used to model the baseline and climate change scenarios. No adjustments were made to parameters to account for possible impacts on land use or soil characteristics, as there is no information available on which to base estimates of potential changes in behavioural parameter sets (UKWIR, 2005). No adjustments were made to abstractions or discharges (all at zero anyway i.e. naturalised) i.e. an assumption was made for the purposes of the investigations that there would be no climate-induced changes in abstractions or discharges.

Starting conditions for the calibrated CATCHMOD model for the river were all previously set to zero with the exception of Q1 (total runoff) and the soil moisture deficit zones. As for the groundwater sources wet, dry and average climate change scenarios have been derived for Reservoir A based on the minimum, mean and maximum CATCHMOD outputs (based on perturbed input rainfall and PET series) for each UKWIR06 model scenario. Minimum, mean and maximum values of deployable output were derived for Reservoir A and then applied in the Headroom model using a triangular distribution.

3.1.5. Impact of climate change on demand for water

The Company has taken account of the impact of climate change on demand as part of the assessment of target headroom. The Company considers that the impacts of climate change on demand are best placed in the headroom assessment due to the uncertainty surrounding the range of potential impacts.

In the WRMP, climate change has been considered in terms of the potential impact on both household and non-household demand. The potential impact of climate change has been assessed by factoring up and down the total household and non-household consumption, in turn, by the percentages recommended in the report *CCDeW: Climate Change and Demand for Water* (Downing et al., 2003). The CCDeW report predicts the impacts of climate change on demand on a regional basis. We have used the regional impact most relevant to our supply area – the EA Thames Region. This represents an increase of 2.5% by the 2020s for non household demand and an increase of 1.4% by the 2020s for household demand, for each WRZ. The 2.5% and 1.4% CCDeW percentages have been used as the minima and best estimates of the target headroom probability distributions. The maxima of the distributions have been based on the recommendations stated in the CCDeW report, of an additional 1.5% on each stated percentage. This equates to an upper bound of the distributions of 4% and 2.9% for non household and household demand respectively. These percentages are lower than used previously in our Draft WRMP and are in full accordance with the CCDeW report, recommended in the EA's Water Resources Planning Guideline.

3.1.6. Results of assessment

Climate change has an increasing impact on target headroom throughout the planning period, increasing from zero impact in the base year (2007/08) to around 40% of target headroom in 2034/35 for the dry year critical period.

The latest UKCP09 climate change projections were published in June 2009. During AMP5 the Company will update its climate change forecasts using this new data, once industry wide guidance on the interpretation of UKCP09 becomes available.

3.1.7. Adapting to climate change – demand management

Reducing the amount of water we pump into our distribution network reduces the amount of water we have to abstract from the ground. This section considers the methods we employ to reduce the amount of water used by our customers.

Leakage

Over the last 15 years, the Company's most significant demand management measure has been its positive approach to leakage management. Leakage has been reduced to below 24.5Ml/d (approximately 15% of distribution input), which is below the Company's calculated economic level of leakage (ELL). The Company has consistently met the regulatory leakage target set by Ofwat, and remains the only Company in the UK water industry to operate a performance contract where its leak detection contractor is paid solely on measured reductions in night flow rates. Following completion of the Company's Economic Level of Leakage assessment included in the Draft WRMP, Ofwat have issued new guidance on the calculation of the Sustainable Economic Level of Leakage (SELL). The SELL takes into account a wider array of environmental, social and carbon related costs and benefits, as well as customers' preferences for leakage reduction. The SELL replaces the previous ELL calculation.

The Company is currently operating below its calculated Sustainable Economic Level of Leakage (SELL) and has no justification for further leakage reductions in the period from 2010-2015. We therefore intend to maintain leakage at the current level of 24.5Ml/d to 2015.

Beyond 2015 we have a longer term leakage reduction target of 12.5% of Distribution Input (DI) by 2034/35. We believe that this longer term target can only be achieved through a substantial mains renewal programme and that further leakage reductions are unlikely to be economic when compared to other demand management or supply side options. However we believe that further leakage reduction should be progressed as it is such an important issue amongst our customers and promotes the right message that water is a precious resource and must be conserved. In the Defra publication "Action taken by Government to encourage the conservation of water", it is stated that Government want, and expect to see, reductions in leakage. We recognise however that Cost Benefit Analysis (CBA) will be required by Ofwat to justify any further reductions below the SELL.

Household metering

The Company's area of supply has been designated an area of serious water stress. Unrestricted demand is rising, and the number of new households is forecast to increase by over 68,000 over the planning period. The Company already fits meters to all new properties and expects to have metered an additional 29,000 previously unmeasured properties in the period 2005-10. At the end of March 2008, over 71,000 households within the Company supply area were metered, equivalent to approximately 28% meter penetration. Through consultation we know that our customers accept that the only equitable way to pay for water is by meter and that the level of metering should be increased substantially. We also take this view and enhanced metering forms an essential element of the Company's strategy.

We will be installing 32,000 meters during the period 2010-2015, similar to the existing rate of metering for 2005-2010. We expect that the metering programme to 2015 will be achieved through a combination of metering of optants and metering on change of occupancy. The rate of metering to 2015 has been reduced from the programme set out within our Draft Water Resources Management Plan due to concerns over the impact on customer bills. The revised programme, which is still above the optant only baseline, is justified by NPV analysis. The cost of installing these meters over the next five years is approximately £8,250k

Beyond 2015, the Company proposes to accelerate its metering programme to achieve full metering (90% penetration) by 2025 using a combination of metering on change of occupancy, compulsory metering, and free meter optants. The proposal to move towards universal metering is strongly supported by our customers and the Environment Agency.

High levels of meter penetration mean that it should be possible to try and influence demand by using tariff control. We propose to introduce a large scale tariff trial in part of our Croydon area of supply once sufficient meter penetration has been achieved after 2015. We will also investigate the possibility of carrying out smaller scale trials in other areas before then (perhaps on new housing estates where all properties are metered) and will review the results of trials being carried out by others. During AMP5 the Company will also consider implementing a rising block tariff on new homes built in accordance with the Code for Sustainable Homes, to help encourage consumers to reduce their consumption.

Water efficiency

We fully recognise our obligation to promote water efficiency and we fully support our customers' views that we should promote new efficiency measures and enhance educational initiatives. We believe that the key areas for achieving water efficiency savings are:

- the education of our customers
- assisting customers to reduce household consumption
- reducing business use
- working with Local Authorities and Housing Associations to reduce the consumption of their housing stock and business premises.

We will meet the new Ofwat base service water efficiency targets for the period 2009 to 2015 and have included these savings within our final planning solution within the WRMP. This work has included a review of the Waterwise final report, *Evidence base for Large-Scale Water Efficiency*, published in October 2008.

Our Business Plan included a schools water efficiency retrofit programme. The schools programme would have included advice and assistance in installing water efficient devices and fittings, and/or replacing sanitary ware with new modern water efficient equivalents. The programme would have given us the opportunity to educate the schools' pupils and staff about a whole range of sustainability matters. The schools retrofit programme was identified as an economically viable scheme in comparison to other options by the Company. Funding of this scheme was not supported in Ofwat's Final Determination.

3.1.8. Adapting to climate change - resource development

In addition to the Company's progressive policies on water efficiency, leakage and metering, new resource development will also be required to meet the projected growth in demand over the planning period. Based on recent work carried out for the Company by Experian Ltd, we expect the population within the Company supply area to increase by over 90,000 by 2034/35 to over 740,000 people.

Whilst demand management measures are a key element in the Company's WRMP to suppress future demand growth, new resource development must be progressed to maintain security of supply. The Company's WRMP demonstrates that there is currently a deficit in available water resources within both Water Resource Zones (WRZ) at times of peak demand and that additional resource is needed during the next five year period to maintain security of supply and to reduce the risk of supply side restrictions.

Reservoir A

Following a comprehensive review of all available resource options the Company has concluded that the expansion of the treatment works capacity at Reservoir A to 70Ml/d forms the least cost approach for future resource development within the supply area. This work is based on a detailed assessment of capital and operating costs, and environmental and social costs in line with industry appraisal guidance.

Reservoir A is a surface water source which is filled during winter months by abstracting water from a river, via River Intake B. One of the anticipated effects of climate change is that winter rainfall will increase. There may therefore be an opportunity to abstract more water from the river in future.

Utilisation of the full peak licence for Reservoir A will provide substantial benefits to the Company and its customers including:

- It will overcome the existing deficit in resources to meet peak demands and, together with existing sources, will help ensure that we can meet average and peak demands for the next 25 years.
- It will provide an immediate improvement to the resilience of the Company's resources to cope with extreme weather conditions, complying with the recommendations of the Pitt Report. Target headroom will be maintained throughout the planning period, avoiding the need for other more expensive and environmentally damaging resource development.
- It will allow the more efficient use of raw water that is already stored and available for use. The increase in output and network capacity will provide more flexibility for use in conjunction with other sources, and will give the opportunity to rest stressed groundwater sources, reducing the risk of supply side failure and the need for emergency measures.
- The scheme will also assist the Company in complying with the requirements of the Security and Emergency Measures Direction 1998 (SEMD) to ensure the provision of essential water supplies. For example, in the event of the loss of a major treatment works, the Company's ability to distribute water throughout the entire distribution network will be improved.
- It provides a low risk solution to a very real problem.
- Greater use of the reservoir in periods of high rainfall may also help mitigate against downstream flooding caused by the source river.

The new daily peak licence of 70Ml/d for Reservoir A was granted by the Environment Agency (EA) in May 2007, recognising the important role that the reservoir can play in meeting peak demand and providing long term security of supply for the Company's customers. As part of the new 70Ml/d licence granted in 2007, the EA has imposed a condition that the Company must install and operate sufficient treatment capacity at Reservoir A to treat at least 50Ml/d by 2015; otherwise the peak licence limit will revert back to 45Ml/d.

In discussions held with Ofwat following the Draft Determination, it was agreed that the project would be carried out in two phases. Ofwat's Final Determination supported sufficient funding for us to carry out the first phase of the project which is to uprate the treatment works at Reservoir A to 50 Ml/d. We awarded the contract for carrying out this work in November 2010. The second phase is programmed to be implemented in 2015-2020.

3.1.9. Review of adaptation

During AMP5 the Company will update its climate change forecasts using UKCP09 data, once industry wide guidance on the interpretation of UKCP09 becomes available. This information will feed into the statutory annual review of the WRMP and may lead to a revised plan being produced.

3.2. Flooding

The risk identification exercise (see section 2.0) identified flooding as a medium risk for the Company from climate change. Following the summer floods in 2007 (which did not affect Sutton and East Surrey Water) there has been considerable effort on risk screening, risk analysis and risk management of the Company's infrastructure and non-infrastructure assets. The results of this effort have been fed into projects that the Company will be implementing between now and 2015.

This section extracts pertinent areas of the Company's reports on flood risk screening, and asset resilience strategy. It details how climate change has been used in this process and how the Company will be implementing the recommendations of the reports. It also looks at future work that the Company may undertake to adapt to climate change.

3.2.1. Overview of assessment of flooding risk

Flood risk was assessed along the criteria set out by OFWAT in their guidance document: *Asset Resilience to Flood Hazards: Development of an analytical framework*. The Company appointed Atkins in October 2008 to review and implement the OFWAT methodology as part of its Business Plan submission to OFWAT. The OFWAT guidance document provides a framework to assess flooding at critical Infrastructure locations and Non-Infrastructure sites to provide improved resilience in terms of economic benefits and in terms of security of supply to both the Company and its customers.

The guidance document advocates a three stage process: Risk Screening, Risk Analysis and Risk Management. The approach to Risk Screening is discussed in this Risk Screening of Infrastructure and Non-Infrastructure Assets Report. The subsequent Risk Analysis and Risk Management stages are reported under separate cover in the 'Asset Resilience Strategy Report' (Ref DG022).

3.2.2. Risk screening

The OFWAT guidance document focuses on the Risk Screening of large discrete assets such as Water Treatment Works, Pumping Stations and major pipelines, since the consequences of their failure is considered to be the most severe. Whilst these assets are seen as the 'key' assets within any water supply system, this study also considered Boreholes, Reservoirs, Water Towers and River Intakes as part of the Risk Screening process. Given the relatively small number of assets owned by the Company, the inclusion of these additional asset types in the Risk Screening process gave greater reassurance regarding the resilience of Company assets. In all, 87 non-infrastructure (i.e. buildings) and 12 infrastructure (i.e. pipeline) assets were identified for assessment.

3.2.3. Fluvial flooding

EA fluvial flood maps were used to identify those locations/sites potentially at risk of fluvial flooding. The flood maps show the extent of the flood risk, and also quantify the probability of a flood occurring at a specific location/site over a period of one year. The flood map predictions are based on the EA's current best information on the extent of extreme floods from rivers or the sea that would occur without the presence of flood defences.

Three separate probabilities, or return periods are employed:

- Significant: the chance of flooding is any year is greater than 1.3% (1 in 75 years)

- Moderate: the chance of flooding in any year is 1.3% (1 in 75 years) or less, but greater than 0.5% (1 in 200 years)
- Low: the chance of flooding in any year is 0.5% (1 in 200 years) or less.

Those areas that are located outside of the extent of the above three categories are reported by the EA as having a chance of flooding of 0.1% each year (1 in 1000) or less. The fluvial flood maps are based on topographical survey data and flow information, and are updated quarterly by the EA.

Using a combination of postcodes and easting (X) and northing's (Y) coordinates for each location / site, 12 Infrastructure and 87 Non-Infrastructure assets were reviewed against the EA flood maps to assess the potential flood risk.

The EA maps have been used to assess the extent of flooding in the area of each of the locations under consideration. Each map states the severity of the flooding and, using the 'Learn more' tool provided on the EA website, a specific flood risk assessment for each site has been documented.

3.2.4. Screening methodology

Using the step by step approach outlined in the Ofwat guidance document, the risk matrix enables the probability and consequences of failure to be visualised for each location/site. The screening process is thus a uniform approach adopted to determine which locations/sites require further investigation, and must be taken forward to the Risk Analysis and Risk Management Stages. For this review, an enhanced risk matrix was developed to identify those locations/sites most at risk from fluvial and historical flooding. A hazard probability (likelihood) score, a service consequence score and a weighting factor were generated for each location/site and then used in a hazard risk rating formula.

Hazard probability

The hazard probability score was based upon the return period of flooding events as defined on the EA flood maps. The risk scores and associated definitions are shown in the table below.

Risk Score	Definition
3	Significant; the chance of flooding in any year is greater than 1.3% (1 in 75)
2	Moderate; the chance of flooding in any year is 1.3% (1 in 75) or less, but greater than 0.5% (1 in 200)
1	Low; the chance of flooding in any year is 0.5% (1 in 200) or less

Service consequence

The service consequence score was derived by reviewing the assets at each of the locations/sites in order to determine their potential for damage. The likely impact on customers (from loss of service for example) could then be estimated. The risk scores and associated definitions are shown in the table below.

Risk Score	Definition
3	Significant; the effects of flooding will result in failure of supply/essential assets
2	Moderate; the effects of flooding may result in failure of supply/essential assets
1	Low; the effects of flooding will not result in failure of supply/essential assets

Weighting factor

A Weighting Factor was applied to each location/site based on local knowledge, and to remove anomalies from the process. The Weighting Factor can have the effect of increasing or decreasing the priority level of these sites. A Weighting Factor of 0.5, 1 or 2 was applied to the risk score formula in order reflect historical flooding at the site. The risk scores and associated definitions are shown in the table below.

Risk Score	Definition
2	Significant; the site is known to flood historically from groundwater or other Sources (eg pluvial flooding)
1	Moderate; it is not known whether there is a risk of flooding on site from groundwater or other sources (eg pluvial flooding)
0.5	Low; this site is not known to flood historically/unlikely to flood from groundwater or other sources (eg pluvial flooding)

A Water Tower is an example of an anomaly. While it may be in an area subject to flooding, the actual water supply may not be affected. Hence, a Weighting Factor introduced into the risk calculation will produce a lower risk score than that solely dependent on the flood risk analysis.

Treatment Works K and W have both experienced flooding in the past. As such, these sites were assigned a Weighting Factor of 2. The application of a Weighting Factor to Woodmansterne Water Treatment Works resulted in the risk level increasing from 'Moderate Risk' to 'Significant Risk'.

Flooding has not been reported at the Water Towers R and W and due to their inherent design they were assigned a weighting score of 0.5.

3.2.5. Results of risk screening

There are four 'Significant Risk' sites are which required further analysis. These sites are considered in the risk analysis section of this report.

It is noted that Treatment Works W specifically falls into this 'Significant Risk' category due to the Weighting Factor of 2 that has been applied in the Risk Score formula to account for historic pluvial flooding at the site.

Site Name	Risk Score	Risk Definition
River Intake B	18	Significant Risk – Existing measures should be in place.
Treatment Works K	12	Significant Risk – Existing measures should be in place.
Pumping Station L	18	Significant Risk – Existing measures should be in place.
Treatment Works W	9	Significant Risk – Existing measures should be in place.

There are three sites which have been identified as being at 'Moderate Risk' with a total risk score of 3:

- Borehole BR
- River Intake G
- Boreholes H

The flood risk at boreholes H and BR are noted as significant according to the EA; however these are only two boreholes of many that supply Treatment Works C and therefore are not considered as critical assets.

The flood risk at River Intake G is also classed as significant according to the EA, however River Intake G does not treat or supply potable water to the public, but instead provides water for recreational purposes, and is therefore not considered to be a critical asset. Consequently, these sites are unlikely to be promoted to 'Significant Risk' in the short term. These three sites will be reappraised in the next asset management period (2015-2020) to ensure that these circumstances have not changed.

With regard to infrastructure sites, the following bridge crossings were highlighted as requiring further analysis (see table below):

Site Name	Risk Score	Risk Definition
Bridge at SP	9	Significant Risk – Existing measures should be in place.
Bridge at FR	9	Significant Risk – Existing measures should be in place.
Bridge at ER	9	Significant Risk – Existing measures should be in place.
Bridge at CS	9	Significant Risk – Existing measures should be in place.

3.2.6. Flood risk analysis

The risk screening process identified four infrastructure and four non-infrastructure sites that required further analysis. A further report was produced that involved a site visit and, where required, detailed flood mapping of the areas.

The flood mapping exercise allowed the modes of flooding and assets at risk of flooding to be identified, through a Failure Modes and Effects Analysis (FMEA).

Following the FMEA study, solutions were developed to provide a minimum of 1 in 200 year flood protection as recommended by the Pitt Report, although analysis was undertaken against a full range of return periods as per the guidance document. A Cost Benefit Analysis assessment was also undertaken in order to select the most cost beneficial solution.

The Risk Analysis and Risk Management stages identified that three of the eight sites under consideration require intervention options for which the most cost beneficial solutions identified are:

Site	Work
River Intake B	Raise existing road
Treatment Works K	Surface water storage and restrict overland flow
Treatment Works W	Surface water storage (lagoon) and restrict overland flow

3.2.7. Accounting for climate change

The flood modelling described above used Light Distance and Ranging (LiDAR) data as its base. It was noted that the LiDAR data is subject to a margin of error of +/-15cm. In addition the EA flood map data utilised by the flood models only considers climate change for the 1 in 100 year return period, as such the effects of climate change on the other return periods was unknown.

In order to fully understand the potential effects of the LiDAR accuracy and climate change over the 40 year design horizon (as recommended in the Ofwat guidance) and the other return periods (1 in 75, 1 in 200, 1in 500 and 1 in 1000), a flood depth table was produced. The table was utilised during the site visits and FMEA assessments to assess the effects of the LiDAR accuracy and potential climate change impact over the projected design horizon for each intervention option.

A climate change figure of 0.3% increase in flood depth per annum has been used in the table. This is the figure quoted in the Ofwat guidance document as an example, and was used in the absence of any more pertinent guidance from UKCIP09 or Defra FCDPAG3 at the time the report was written.

3.2.8. Work planned to be done within next five years

The work being undertaken over the next five years will significantly improve the Company's overall resilience to flooding. The specific works are:

Site	Work
Treatment Works K	Surface water storage and restrict overland flow
Treatment Works W	Surface water storage (lagoon) and restrict overland flow

Our Final Business Plan included the work proposed at River Intake B, to raise the existing road, but funding was not supported in the Final Determination.

3.2.9. Review of adaptation

The work Sutton and East Surrey Water will undertake up to 2015 will protect the Company from 1 in 200 year events at all sites except our river intake. As more information becomes available, We will re-evaluate the risks to all 87 non-infrastructure and the 12 infrastructure sites. New information could be in the form of the EA updating its flooding map (as we have recently been advised) OR more guidance on the use of UKCP09 for the use in flooding assessments.

3.3. External infrastructure failure

3.3.1. General

The risk identification exercise (see section 2.0) identified external infrastructure failure as a result of climate change as a medium to low risk for the Company. However the risk assessment did not consider effects to the road network and only briefly considers the effects of a telecommunications failure.

We define external infrastructure as being:

- Electricity
- Telecommunications
- Road network

No formal report sets out the methods for dealing with these items with regard to climate change adaption. Due to the consequence of electricity and telecommunications system failures, the Company has developed a level of resilience to them.

This section considers the Company's current preparedness for these failures. It assumes that the authority responsible for the infrastructure affected has resources in place to deal with the failure within 48 hours, i.e. they have considered climate change adaptation and have systems in place for dealing with the resultant effects.

3.3.2. Electricity

Sutton and East Surrey Water use a significant amount of electricity in the abstraction, treatment and distribution of water. Over the financial year 09/10 we used 50.6GWh of electricity. We are highly dependent on a good supply of electricity to our works.

The report, *Adapting Energy, Transport and Water Infrastructure to the Long-term Impacts of Climate Change* (URS Corporation, January 2010) highlights failure of electricity supply as a medium risk in the 2030s rising to high risk in 2050.

Existing provision
Sutton and East Surrey Water has standby generator sets at all of its major treatment works and larger pumping stations. In addition to this the Company has six mobile generator sets which can be deployed at strategic locations throughout the Company's area. In the high level risk assessment (see section 2.0) only "water networks" were considered a "medium risk".

Electricity for water networks
A small number of pumping stations are not serviced by standby generators. These are some our smallest pumping stations and are in areas with a large reservoir capacity which would gravitate to meet customer demands. It is at these sites that the mobile generators would be stationed.

The main area for which the Company does not have backup electricity provision is its reservoir sites. Electricity is used at these sites to provide level and intruder information back to the local treatment works and centralised control systems. Currently, if power fails at these sites we have a number of procedures to ensure that the level is checked and the site is secure.

For a few of the reservoir sites we have invested in renewable energy sources. We have found that the installation of such technology draws unwelcome attention to the site and in a number of instances has not remained on-site for any length of time.

We are keeping under review the technologies currently being adopted for Smart Metering can be adapted to send reservoir level data or data on security. This is due to their minimal power consumption requirements.

Issues with standby generation
Gasoil generators require regularly maintenance and testing to ensure that they are available during periods when power fails. A number of our generators are coming to the end of their usable life and therefore the Company will be making an assessment on their suitability and carrying out work the required work as appropriate.

It should be noted that except at times of high electrical demand, it is more expensive to generate power from standby generators than from the grid.

Changes in fuel composition, especially the inclusion of biodiesel in gasoil, mean that the fuel stored for standby generation use tends to degrade within a relatively short period of time.

3.3.3. Telecommunications

Sutton and East Surrey Water relies on the telecommunications infrastructure for communication between employees and for the relaying of information on the operation of its treatment and pumping plant.

Operational Inter-personnel communications
The Company has its own radio network which it would use in the event of disruption of the normal telecommunications systems. In addition to this key members of staff are allocated mobile phones which are registered under Access Overload Control procedure.

The structure of the operations function means that staff are dispersed around specific nodes in the company's operational network.

Although prolonged failure of the normal communications network would inconvenience operations it would not affect the Company's ability to deliver potable water to its customers.

Customer service communications
Failure of the telecommunications would severely affect the ability of our customers to contact us with any issues that they may be experiencing. This may lead to a delay in our response to operational issues eg burst main.

Transmission of site based data
During normal operating hours, the operations of the Company's equipment is dispersed to the local treatment works. Outside of these hours the Company receives operational information back to its control room at Redhill.

The treatment works and pumping stations are extensively automated. This means that they can operate without interference as long as there is not an alarm condition. In critical alarm condition the treatment works will automatically shutdown.

The major risk from telecommunications failure is the loss of supervisory control, alarms and data acquisition when the sites are not manned. In the short term, the Company has procedures for dealing with this level of failure.

3.3.4. Road network

Sutton and East Surrey Water supply area is within a tight geographical area which is well serviced by the road network. Further, the majority of our operational and customer service staff live within the Company area.

Excluding the motorways (M23 and M25), failure of one or several roads would not have a large impact on the Company's operations. Long term failure of the M25, defined as a closure, causes congestion on the surrounding roads and would have an immediate impact our staffs' ability to carry out their tasks. Short term failure of this motorway is a known risk of living in our area. Prolonged closure would cause a significant impact to the Company's operations as well as the wider economy.

Access to major treatment works
We believe that, with the exception of treatment works K which is solely reliant on a major A road remaining open, access to our treatment works is good.

Treatment Works	Road access
B	Multiple B road access
C	Multiple A road access
E	A road and motorway access
G	Good A road and motorway access
K	Single A road access – main truck road
Ww	A road and other road access – emergency route via motorway
W	Good B road and minor road access

It should be noted that none of our treatment works or major pumping stations would be isolated by the failure of a road bridge and none of them are accessed across rivers or railway lines.

Extreme weather
The recent extreme snow and temperatures experienced (December 2010) demonstrated that we are reliant on the local highway authority keeping the roads open. Prolonged failure of the road network (defined as greater than 2 days) can lead to a degradation in our customer service function because our staff are unable to get to the office.

Our operational department has a level of resilience, in the form of four wheel drive vehicles, which ensure that we are able to maintain the required levels of service to our customers. We also ensure that we maintain at least two week's supply of treatment chemicals at the treatment works. It should be noted that prolonged failure of the road network leads to a backlog of deliveries from our chemical suppliers and can lead to chemical levels at the treatment works becoming low. So far we have not encountered conditions which have tested this resilience

3.4. Other known effects

3.4.1. Impounding reservoir with earthfill embankment

Most earth fill embankments in this country will not have taken climate change into account when they were designed. There is potential for change in the behaviour of an earth fill embankment if temperature extremes are greater than anticipated during design (e.g. drying out and cracking of the downstream face due to extreme drought conditions).

Sutton and East Surrey Water has one earth fill impounding reservoir. The risk identification exercise showed this as a "medium risk". This medium risk is driven by the catastrophic consequences arising from dam failure, including loss of life and water resource. However, at this time, the probability of failure occurring is considered to be very low

We are currently exploring with the reservoir's "panel engineer" the effects of climate change on the earthfill embankment. We note the report written by DEFRA on this subject *Climate change impacts on the safety of British reservoirs* (Defra 2002).

3.4.2. Water quality

There have been a number of studies looking at the effect of climate change on raw water quality. These have included UKWIR 05 CL 06 4 *Effects of Climate Change on River Water Quality* which states that climate change "*may have significant implications for reservoir dynamics, which may for example include increased nutrient supply and enhancement of phytoplankton populations (e.g. algal blooms) in increasingly likely drought years, when reservoirs would be drawn down and more likely to exhibit such characteristics*."

We agree with the above statement and expect that climate change will increase the algal blooms in our surface water reservoir. Although we believe that this is likely to happen, the consequence to the Company is that we have investigated measures to improve the resilience of the reservoir. We will take these measures when we have evidence of increased algal blooms.

15% of the Company's water comes from a surface water reservoir. In recent years we have had problems with farm based micro-pollutants which has led to an improvement in the resilience of the treatment works to these substances. We believe that as climate change impacts the agricultural industry the site will be challenged by other types of micro-pollutants which may mean that we have to review the resilience of the works and/or incorporate other measures to reduce their effect on water quality

85% of the Company's water comes from borehole sources. It has been suggested that more frequent storm events may cause greater runoff or diffuse pollution. To date we have seen no evidence of this and evidence from other countries suggests that this may not happen. It should be noted that there are other risks to groundwater e.g. infiltration of pollutants, present a higher risk. We will continue to monitor the raw water and react to any changes in its composition.

Work is currently being undertaken by UKWIR into the effects of climate change on treatment processes employed by Water Companies. Based on experience in Mediterranean countries we do not expect climate change to have a profound effect on our treatment processes.

3.4.3. Personnel

The change of climate is relatively benign and slow. Because of the degree and pace of change, we do not expect climate change to pose any personnel issues.

There are issues surrounding the commute to the normal place of work which have been explored in section 3.3.4 of this report, especially with regard to extreme weather conditions.

3.4.4. Mechanical and electrical assets

Our mechanical and electrical assets have been designed to British, European and International Standards. Taking temperature tolerances for low voltage switchgear as an example, BS EN 60439:1999 allows a temperature range of -5 C to 40 C, with an average over 24 hours of 35 C. Our low voltage switchgear is typically mounted in rooms which have air conditioning, natural ventilation, and/or natural cooling from the water running through our pipes.

We anticipate that as the climate changes the engineering standards will change and this will drive adaptation for mechanical and electrical assets. Typically our mechanical and electrical plant typically has a life of 25 years with different assets at different stages in their life i.e. some are relatively new, some are half way through their asset life, and some are due for replacement.

We therefore believe that climate change is a low risk to our mechanical and electrical assets since the assets will naturally be replaced with assets that have been adapted for climate change.

SECTION 4.0

SUMMARY OF ACTIONS PROPOSED

TO ADDRESS CLIMATE CHANGE

4. Summary of actions proposed to address climate change

The following table gives a summary of the actions proposed to address climate change, the time span and costs. Some of these actions are:

Risk	Timescale	Action	Estimated Cost
Insufficient water resources	2010-2015	Planned water meter installation	£ 8,000k
		Water efficiency measures	£ 500k
		Maintain current level of leakage	£ 20,000k
	2015-2030	Increase treatment capacity at Reservoir A	£ 5,000k
		90% metering	£ 27,000k
		Maintain current level of leakage	£ 60,000k
		Reduce leakage	£ 30,000k
		Water efficiency measures	£ 1,500k
Flooding	2010-2015	Measures at treatment works K & W	£ 1,400k
	2015-2020	Measures at River Intake B	£ 400k
Loss of Power and/or telecommunications	2015-2030	Low power data transmission equipment for reservoirs	£ 1,000k
Increased reservoir algal blooms	2025-2050	Install improved mixing equipment	£ 500k

SECTION 5.0

UNCERTAINTIES AND ASSUMPTIONS

5. Uncertainties and assumptions

5.1. What are the main uncertainties in the evidence, approach and method used in the adaptation programme and in the operation of your organisation?

Our main uncertainty is that our evidence, approach and method are still based on UKCIP02 data. Although commissioned independent analysis suggests that the outcomes will not be significantly different, it is not until the water industry has completed research on UKCP09 scenarios that this uncertainty will be removed.

In our assessment of the risks from flooding we have used the EA Flood Maps. The limitation of the maps with regard to climate change is that although the flood maps consider climate change that has already taken place, they do not include for future climate change. In addition the flood maps do not cover flooding as a result of pluvial events, highway drainage, sewers, overland flow or groundwater. We have considered our position taking into account actual events experience. We have then assumed that the situation may get worse.

5.2. What assumptions have been made when devising the programme for adaptation?

There are a number of basic assumptions which have been included in our adaptation programme. These are:

- the water industry will exist in its current form with the same regulators and regulatory regime.
- we will continue to provide the same level of service to our customers.
- there will be no major population increase within our supply area beyond that which we have predicted in our WRMP.
- we have assumed that other authorities will be adapting to climate change and in the case of other infrastructure companies that there loss of service will be limited to 48 hours.

SECTION 6.0

BARRIERS TO CLIMATE CHANGE ADAPTATION

6. Barriers to climate change adaptation

6.1. Investment

Key barriers to climate change adaptation are:

- the cost of making the required investment
- the timing of the investment
- how should the investment be funded (e.g. through taxation or through water rates)

Currently, in the water industry, the cost of the investment is made by the water companies, funded by customers through water charges. The timing is determined by companies and set out in their water resource management plans and businesses plans, but dependent on the economic regulator's Final Determination.

Our Final Business Plan (April 2009) identified the upgrading of the treatment works at Reservoir A as being required to meet the water supply/demand balance, partly due to climate change. We based this view on the best available information at the time. Our economic regulator, OFWAT, took the view; that it, "*would not allow for significant climate change-driven expenditure to balance water supply and demand in price limits without satisfactory supporting evidence based on UKCP09 scenario analysis*". As a consequence, a compromise was agreed where the proposed scheme would be built in two phases. Using net present value, this was less cost beneficial to customers, but meant that in the short term bill increases would be less.

In its Final Determination, Ofwat did conclude that a notified item was required for increased costs necessary to balance water supply and demand, based on companies' application of UKCP09 data and appropriate analytical tools and processes. Given the current lack of industry wide interpretation of UKCP09 it is unlikely that such evidence will be available until the next Business Plan (2014). Generally, Ofwat's approach has meant that some investment in climate change adaptation has been deferred because of uncertainty. While the degree of uncertainty may reduce over time, there will always be uncertainty until the risk actually manifests itself (so, for example, we might get to the next review and a new set of climate change scenarios may be being prepared. Are we going to wait another five years before making any investment?). A decision needs to be taken at Government level as to whether we are going to invest in climate change adaptation or not, and when. If we keep deferring the date of investment, it may be too late. Large reservoir projects can take 20 years or more before the additional water resource becomes available.

In addition, a decision needs to be taken with respect to major projects, as to whether one companies customers should pay for an adaptation proposal that gives a wider benefit to the population as a whole, or regionally.

6.2. Public understanding

One of the barriers to the development of resilience to climate change is the publics' understanding of the need to adapt to climate change. Unfortunately it is not until somebody is affected by lack of water, flooding or similar circumstance that they are willing to pay for changes in the infrastructure.

We are also dependent on our customers making behavioural changes if we are going to successfully reduce water usage. This will require the support of central government, local authorities, developers, white goods manufacturers etc. Our own Company has taken

proactive steps in changing customers' behaviour and improving water efficiency. An example of this is the work we have carried out in the "*Tap into Savings*" programme. We have recently been awarded a Green Apple Environment Award for this work

6.3. Other information

Our assessment of the impact of climate change is based on information that we hold and that is freely available. There are some impacts which requires information concerning over companies assets, for example the resilience of the local electricity network or the local sewer network.

An example of this is the lack of information on pluvial flooding meant that we had to use an historical evidence based approach for our non-infrastructure sites (eg treatment works). We appreciate that there is a concern about putting data on pluvial flooding into the public domain because, for example, of the possible effect on house prices. We also appreciate that this data may not be available or may change due to climate change and population growth. However without detailed information we can only use anecdotal evidence over possible pluvial flood risks.

6.4. Analysis of UKCP09 data

The analysis of UKCP09 data and how it affects the water industry is being carried out but is not yet complete. This is a short term barrier to determining the likely consequences of climate change which is likely to be rectified over the next five years. The concern, which feeds into investment (see section 6.1), is that by the time the data has been analysed, a revised climate change model will have been produced.

When issuing climate change reports, a clear understanding is required on how the new model differs from the previous model. Advice is also required on how the data should be interpreted. For instance in this report we have considered a medium emissions scenario in how we adapt to climate change: we appreciate that other stakeholders have taken a different view.

SECTION 7.0

MONITORING AND EVALUATION

7. Monitoring and evaluation

7.1. How will the outcome of the adaptation programme be monitored?

Climate change presents a high risk to water resources and flooding. We have identified these risks, agreed funding with our regulators and will be installing additional resilience over the current regulatory period (2010-15). We have internal key performance indicators (KPI's) that monitor progress on our adaptation programme and other works within the company.

Information on the performance of our programme is forwarded to OFWAT at least once a year (in June). We also provide information on how we are mitigating the affects of climate change.

The resultant risk of climate change is monitored at board level in the form of a risk register and reviewed on an annual basis. This review process influences the adaptive actions the company undertakes and incorporates within its Business Plan.

7.2. How will the thresholds, above which climate change impacts will pose a risk to your organisation, be monitored and incorporated into future risk assessments?

We routinely monitor variables that have an impact on our business. This includes demand from our customers; river and borehole levels, raw water quality etc. Some of the variables we monitor are direct consequences of climate change eg air temperature and precipitation levels. This information builds a history of how these variables are changing.

We review key variables on a weekly basis through the setting and monitoring of KPIs. Trends are then used in our Business Plans to justify additional resilience to adapt to the changes we are experiencing.

7.3. How will the residual risks of impacts of climate change on your organisation and stakeholders be monitored?

The size of our Company means that we rely on industry research and forums to keep abreast of risks that are currently considered residual. We have staff that participate in climate change, sustainability and carbon groups as well as UKWIR and WRC research projects.

None of the residual risks that we have identified is specific to our Company.

7.4. How will you ensure that the management of climate change is firmly embedded in your organisation?

A stated aim in our business plan is:

"to provide greater resilience to help withstand the challenges of climate change, and reduce our impact on the environment."

We trust that this statement, together with the actions we are proposing to take as outlined in this document, in our Water Resources Management Plan, and our PR2009 Business Plan, will satisfy the Secretary of State that management of climate change is firmly embedded in our organisation.

Currently, responsibility for implementing our climate change mitigation and adaptation proposals is devolved to either our Operations Director or Engineering Director. The Board is proposing to give climate change a higher profile by asking one of its Directors to take on the role of climate change 'champion'. The 'champion' will take overall responsibility for overseeing all aspects of climate change adaptation and ensuring the Company addresses the challenges we face.

7.5. How will you enable your management of climate change risk to be flexible?

Climate change risk is just one of the risks to our business. The forecast risk from climate change is less than most of the other risks that we face and is on a much longer term. The resilience that we have developed in responding to other risks is transferrable to the risks associated with climate change.

Where the risks to our business are unacceptable, for example through the lack of water resources or flooding of major assets, we have already put in place plans to mitigate the risks. The mitigation measures being undertaken, or proposed, are discussed within this report.

Where the risk to our business is residual or where adaptation measures can be taken over short periods of time, we have adopted a, "wait and see" approach. An example of this is our response to the potential increase in algal blooms in our impounding reservoir.

7.6. Has the production of this report led to a change in your management of climate change risks?

We welcome the emphasis that the Government is giving to climate change and to the steps that are being, or need to be taken to mitigate or adapt to the forecast effects of climate change. We hope, however, that this report will reassure Government that the Water Industry, in particular Sutton and East Surrey Water, and its Regulators, have already taken significant steps to identify the risks and opportunities associated with climate change and address them.

SECTION 8.0

GLOSSARY

AMP	Asset management period. AMP5 refers to the regulatory period running from April 2010 to March 2015.
CATCHMOD	Catchment Modelling. Modelling of water catchment areas development for the Water Framework Directive.
CBA	Cost benefit analysis
DWi	Drinking Water Inspectorate. Water quality regulator
EA	Environment Agency
ELL	Economic Level of Leakage
FMEA	Failure modes and analysis
Headroom	The minimum buffer that a prudent water Company should allow between supply and demand to cater for specified uncertainties in the supply demand balance.
OFWAT	Economic Regulator for the Water Industry
SELL	Sustainable economic level of leakage
UKCIP02	UK climate change impact predictions
UKCP09	UK climate change prediction
WRMP	Water Resources Management Plan
WRZ	Water Resource Zone

SECTION 9.0

REFERENCES

1	Sutton and East Surrey Water Strategic Direction Document, http://www.waterplc.com/userfiles/file/StrategicDirectionStatement_2007.pdf
2	Sutton and East Surrey Water Final Water Resources Management Plan, http://www.waterplc.com/userfiles/file/Final_WRMP.pdf
3	Sutton and East Surrey Water / Atkins, Internal report, Flood Risk Screening of Infrastructure and Non-Infrastructure Assets, rev 2 March 2009
4	Sutton and East Surrey Water / Atkins, Internal report, Asset Resilience Strategy Report, rev 1 March 2009
5	Sutton and East Surrey Water / Atkins, Internal report, K and W Water Treatment Works Flooding Investigations, rev 2 January 2008
6	OFWAT Strategic aims www.ofwat.gov.uk
7	UK Climate Change Predictions 2009, http://ukcp09.defra.gov.uk/
9	Risk & Safety 1, The Chemical Engineer 812, February 2009, Paul Davies
10	Adapting Energy, Transport and Water Infrastructure to the Long Term impacts of climate change – URS January 2009
11	Water Resources Management Plan Regulations 2007 (2007/727)
12	A Climate change adaptation approach for asset management planning – MWH/Water UK November 2007.
13	Catchmod
14	OFWAT Reassessment of Groundwater Source Deployable Outputs, ref 5030095/DG/70/109
15	CCDeW: Climate change and the demand for water, Downing et al. 2003.
16	DEFRA Action taken by government to encourage the conservation of water,
17	Evidence base for Large-Scale Water Efficiency, Waterwise, 2008.
18	OFWAT Asset resilience to flood hazards: Development of an analytical framework.
19	UKWIR 05/CL/04/3 Effect of Climate Change on River Flows and Groundwater Recharge - A Practical Methodology
20	UKWIR 05/CL/04/4 Climate Change Uncertainty in Water Resource Planning
21	UKWIR 05/CL/04/5 Effect of Climate Change on River Flows and Groundwater Recharge
22	UKWIR 05/CL/04/6 Effect of Climate Change on River Flows and Groundwater Recharge
23	UKWIR 06/CL/04/7 Effect of Climate Change on River Flows and Groundwater Recharge
24	UKWIR 06/CL/04/8 Effects Of Climate Change On River Flows And Groundwater Recharge: Guidelines For Resource Assessment And Ukwir06 Scenarios
25	UKWIR 06/CL/04/9 Effects Of Climate Change On River Flows And Groundwater Recharge
26	UKWIR 08/CL/01/7 Climate Change - A Programme of Research for the UK Water Industry. Volume 1 - Summary Report
27	UKWIR 97/CL/04/1 Effect of Climate Change on River Flows and Groundwater Recharge
28	UKWIR 09/CL/04/11 Assessment of the Significance to Water Resource

	Management Plans of the UK Climate Projections
29	UKWIR 03/CL/09/1 Uncertainty and Risk in Supply/Demand Forecasting Final Report – Volume A
30	UKWIR 03/CL/09/2 Uncertainty and Risk in Supply/Demand Forecasting Final Report - Volume B
31	UKWIR 00/CL/06/1 Review of River and Reservoir Water Quality Models for Predicting Effects of Climate Change
32	UKWIR 01/CL/06/2 Modelling the Effects of Climate Change on Water Quality in Rivers and Reservoirs
33	UKWIR 03/CL/06/3 Effects of Climate Change on River Water Quality Phase 3 - Scoping Study
34	UKWIR 05/CL/06/4 Effects of Climate Change on River Water Quality
35	UKWIR 07/CL/06/5 Climate Change, The Aquatic Environment and the Water Framework Directive
36	UKWIR 03/CL/08/1 Potential for Impact of Climate Change on Water Quality in the UK - Volume 2A - Plankton Environmental Change with Dynamics in Relation to Particular Reference to Water Treatment Supply
37	DEFRA Adaptation Policy Framework
38	DEFRA Climate Change Bill (consultation to June 2007)
39	DEFRA Government Water Strategy (under development)
40	DEFRA Making Space for Water: Taking forward a new Government strategy for flood & coastal erosion risk management
41	EA Water Resource Planning Guidelines - Draft Protocol Guidance on accounting for climate change implications in estimates of water resource zone deployable output for PR09
42	EA Water Resource Planning Guidelines (April 2007). Chapter 8 Climate Change
43	EA Water Resource Planning Guidelines (April 2007). Chapter 11 Options Appraisal
44	EA Water Resources Strategy for England and Wales - consultation
45	EA Identifying Areas of Water Stress, January 2007.

APPENDIX A

DIRECTION LETTER FROM SECRETARY OF STATE

Nicholas J. Fisher
Sutton & East Surrey Water Plc
London Road
Redhill
Surrey
RH1 1 LJ

Adapting to Climate Change

Area 3A
Nobel House
St Smith's Square
London
SW1P 3AL

February 2010

Dear Mr. Fisher,

Direction to report on adaptation under the Climate Change Act 2008

We sent you a draft Direction for comment on the 15 December 2009. As we received no response from your organisation, we assume you had no concerns and so are now formally issuing the Direction. In this letter we explain the Direction, the reporting process, and answer questions that have arisen from other reporting authorities' responses.

Please find the Direction attached; this is a legal instrument, which places a requirement on you to report, outlining the issues covered in the Direction, and to deliver a report **by 31 January 2011**.

1. Amendment to the explanatory note to the Direction

Please note that we have made a slight amendment to the explanatory note of the Direction, and removed the points (b) and (c) from the following paragraph:

"In preparing the report, the reporting authority is required by section 63(3) of the Climate Change Act 2008 to have regard to:

a) the guidance issued by the Secretary of State under section 61 of the Climate Change Act 2008;

b) the most recent report under section 56 (report on impact of climate change) of the Act (if there is a report);
c) the most recent programme under section 58 (programme for adaptation to climate change) of the Act (if there is a one)."

We removed (b) and (c) after some reporting authorities had expressed concerns that they would have to back track and re-do parts of the report if the report on the impact of climate change and programme for adaptation to climate change came into force during the reporting process. In reality, (b) refers to the UK's first Climate Change Risk Assessment and (c) refers to the National Adaptation Programme neither of which will be published until 2012, after this round of reporting has ended (November 2011). To avoid any confusion, and to take reporting authorities' concerns on board, we have removed points (b) and (c).

2. Devolution and Coverage of the Direction

The Secretary of State has the power to issue Guidance and Directions to reporting authorities in Wales, Scotland and Northern Ireland, in relation to their non-devolved functions. Where appropriate we have consulted or sought consent from the government of devolved administrations as required by section 64 of the Climate Change Act 2008 and this has been given. The Direction does not apply in respect of any devolved functions of your organisation. The Direction does not apply in respect of any activities of the reporting authority which are: (i) outside of the United Kingdom; and (ii) which do not relate to any of its functions within the UK that are of a public nature or are part of its role as a statutory undertaker.

3. Deadlines

While some water companies stated that they would be able to meet our proposed deadline of 30 November 2010, other organisations felt that they would need longer to produce the reports. Therefore to take on board these concerns, we have decided to move the deadlines for all water companies' reports to **31 January 2011**.

4. Submitting the report

The deadline specified in your Direction is the deadline for submitting your report to the Secretary of State. From this date, there will be a period of 3 months after which the Secretary of State will comment on the fitness for purpose of the report. If we have judged that you have not had sufficient regard for the Statutory Guidance or fulfilled the requirements of the Direction, then you may be asked to re-do some parts of the report. You will then have 3 months to take on board comments and submit a final report to the Secretary of State. In reality therefore, if your deadline is 31 January 2011, your report may not be made publically available until August 2011.

5. Security and Confidentiality

We would like to reiterate that we understand that some information in your report may be sensitive for commercial or security reasons. However, the Government is committed to putting as much information as possible into the public domain, and is legally obliged to publish the full report except for information which can be withheld in accordance with the exceptions in the Freedom of Information Act 2000 (and related regulations) including the Environmental Information Regulations 2004, or for which disclosure is prohibited by another piece of legislation. **We would therefore ask you to mark any information that you think should not be published, and submit a second, redacted version alongside the complete report.** The Secretary of State will confirm that your redacted report complies with these regulations within 3 months of being submitted. If not, you may be required to re-submit your report.

6. Evaluation of the reports

An external risk expert institute, the Cranfield University Risk Centre, will analyse the quality of the risk assessment in each report and also produce sector summaries of the risks. Policy judgements on the basis of the reports remain the responsibility of individual government departments. The adaptation measures in the reports will be looked at by the Adapting to Climate Change Programme and officials in each relevant government department, so reports from the water sector will be examined by policy leads in Defra. They will also take responsibility for analysing and considering any actions arising from the reports for their sectors.

The combination of Cranfield's experience and departments' views will constitute the Secretary of State's response to the fitness of your report. The Adapting to Climate Change Programme alongside relevant government departments will then develop a cross sectoral summary of all the reports.

7. Statutory Guidance

Reporting authorities are required by section 63(3) of the Climate Change Act 2008 to have regard to Statutory Guidance when producing their reports. The Statutory Guidance was published on the 26 November 2009, and can be downloaded from our website at the following link: http://www.defra.gov.uk/environment/climate/documents/statutory-guidance.pdf. For more information on how to use the Statutory Guidance, please see our 'FAQs' which have been published on Defra's website[1]. The Statutory Guidance we have published will help you to understand what we require in a report and provide you with information on approaches to risk assessment and developing action.

[1] http://www.defra.gov.uk/environment/climate/legislation/reporting.htm

8. Environment Agency's Supplementary Guidance

While all reporting authorities welcomed the Environment Agency's Supplementary Guidance as an additional source of information, many requested more clarity on its level of detail and publication date. I can therefore confirm that the 'supplementary guidance' will be published on the Environment Agency's website in March 2010, which should give reporting authorities ample time to utilise it when producing their reports. It is intended to complement the Government's Statutory Guidance, but it should be noted that, **unlike the Statutory Guidance, reporting authorities are not obliged to have regard to it.**

The Environment Agency has significant expertise in planning for climate change and its guidance will make it easier to find out what the Environment Agency can and cannot provide. It signposts data, advice and tools for assessing climate risks in core Environment Agency areas, such as flood risk, coastal erosion and water resources. It also explains where the Environment Agency may be able to offer further support.

9. The role of Ofwat

Ofwat has also been identified as a priority reporting authority and will be asked to report on how it considers climate change will affect its ability to fulfil its functions, and what action it proposes to take on this.

The Statutory Guidance makes it clear that we expect regulatory reporting authorities to outline how their framework could provide incentives for effective adaptation. This might be through addressing market failures, most commonly by amending existing, or creating new, instruments to account for climate risk and adaptation.

Regulators will be reporting **after** those that they regulate, so that they can take into account their sector's risks and plans for adapting in their reports. We propose to share your report with Ofwat before it is made publically available for this purpose. Ofwat will not have a formal role in assessing the quality of the water sector's reports in this round but we feel it should be aware of the key messages before producing its own report. Ofwat will then want to work with Defra to consider the wider actions that may need to be taken as a result of the information gathered from the sector. Ofwat's report will also provide vital information on action which may be needed by Government to break down regulatory barriers to adaptation.

10. Report on adapting infrastructure in the energy, water and transport sectors to the long term impacts of climate change.

A two-year (to March 2011) cross-departmental Infrastructure and Adaptation project has been set-up to identify and examine strategic solutions to improve the long-term resilience of new and existing infrastructure in the energy, telecommunications, transport and water sectors to future climate change impacts. The project's first output, a study on the technical and operational risks from climate change on infrastructure in the energy,

transport and water sectors is currently being finalised and will be made publicly available. This will be sent to you on its completion, expected to be in March. It will also be made available via a new 'infrastructure section' on the Defra Adaptation website.

11. Data Gaps

In the letters and draft Directions we sent to you in December, we asked if you felt there were any gaps in the data available to you which compromised your ability to produce comprehensive reports. Some organisations identified gaps in the data around wind, snow and ice, lightning activity, flood depth (for causes other than fluvial and tidal).

Thank you for this information which is extremely useful in our continued prioritisation of our evidence strategy. We have taken these comments on board, and in particular with reference to work that we are requesting from the Met Office to enhance the current UK Climate Projections through investigating ways in which projections of wind and snow might be provided. The Met Office is also planning the publication of a technical note on lightning. The work on these issues will be carried out throughout 2010 and we will keep reporting authorities updated on its progress.

12. The UK's first Climate Change Risk Assessment

We would like to take this opportunity to inform you that under the Climate Change Act 2008, Defra is required to conduct a Climate Change Risk Assessment (CCRA) for the UK to lay before Parliament by 26 January 2012. I attach a summary of the risk assessment method (which is currently being piloted and so may be refined). This does not affect your requirement to report under the Adaptation Reporting Power or the Statutory Guidance to reporting authorities.

For your information the HR Wallingford-led consortium who are helping Defra undertake the CCRA are carrying out the pilot study in the water sector to test the risk assessment methodology. This involves a series of steps to understand the potential consequences of climate change. The scale of assessment is regional, so while data may be collected at a finer scale, such as water resources zones, results will ultimately be presented for Devolved Administrations and English Regions.

The pilot analysis will be based primarily on existing evidence including published water company plans, Environment Agency studies and the research literature. However the pilot would be greatly improved by collecting a small amount of additional information that underpins the current draft Water Resources Management Plans. This should be existing information and you will not be required to undertake any further analysis for the pilot. Sutton & East Surrey Water plc may be approached by HR Wallingford during the next two months and we would appreciate your help at this important stage.

13. Support

We have recently published a 'Frequently Asked Questions and Answers' pack on our website[2]. There is no statutory requirement for any reporting authority to have regard to our answers but we hope that they will provide clarity over: the reporting process, how to use the Statutory Guidance, scientific evidence, and what will happen to the reports. If reporting authorities feel there are omissions to the pack, please let the Adapting to Climate Change Programme know[3] so that we can keep it as an up to date source of information.

We look forward to working closely with your organisation throughout the development of its report. If you would like to discuss this further please contact Sally Belfield (Sally.Belfield@defra.gsi.gov.uk 0207 238 4570) or Helena Busby (Helena.Busby@defra.gsi.gov.uk).

Please confirm receipt of the Direction by sending an email to acc_reportingpower@defra.gsi.gov.uk.

I am copying this letter to Ofwat, and WaterUK.

Yours sincerely,

Clare Hawley
Adapting to Climate Change Programme
Department for Environment, Food and Rural Affairs

[2] http://www.defra.gov.uk/environment/climate/legislation/reporting.htm
[3] Please send an email to: acc_reportingpower@defra.gsi.gov.uk

Direction

Climate Change Adaptation Report by Sutton & East Surrey Water plc Direction 2010

The Secretary of State has been conferred powers by section 62(1) of the Climate Change Act 2008 to direct certain persons or bodies known as "reporting authorities"[1] to give reports about adaptation to climate change.

He makes the following Direction to Sutton & East Surrey Water plc under the powers conferred by that section:

Citation and Commencement

1. This Direction may be cited as the Climate Change Adaptation Report by Sutton & East Surrey Water plc Direction 2010. It has immediate effect.

Interpretation

2. -In this Direction-
   "the reporting authority" means Sutton & East Surrey Water plc

Direction

3. The reporting authority must prepare and send to the Secretary of State a report containing:
   (a) an assessment of the current and predicted impact of climate change in relation to the reporting authority's functions;
   (b) a statement of the reporting authority's proposals and policies for adapting to climate change in the exercise of its functions and the time-scales for introducing those proposals and policies.

4. The assessment of impact referred to in paragraph 3(a) must include:
   (a) a summary of the statutory and other functions of the reporting authority;
   (b) the methodology used to assess the current and predicted impacts of climate change in relation to those functions; and
   (c) the findings of the assessment of the current and predicted impact of climate change in relation to those functions.

5. This report must be prepared by **31 January 2011**.

[1] See the definition of "reporting authority" in section 70 of the Act.

Representations as to information that should not be published.

6. The reporting authority must, in its report, make representations as to any information in its report which it considers should not be published. Representations must demonstrate that this information is information that the Secretary of State is not obliged to publish on the basis that it meets one of the exemptions in section 63 (7) of the Climate Change Act 2008, namely:
    (a) that it is information which the Secretary of State could refuse to disclose in response to a request under the Freedom of Information Act 2000, or the Environmental Information Regulations 2004 (SI 2004/3391) or any regulations replacing those regulations; or
    (b) that it is information whose disclosure is prohibited by any enactment.

Signed by Authority of the Secretary of State,

Clare Hawley
A Senior Civil Servant in the
Department for Environment, Food and Rural Affairs

Explanatory Note

(This note is not part of the Direction)

This Direction requires the reporting authority to prepare a report about the impact of climate change on the reporting authority's functions and policies, and its proposals for adaptation. The reporting authority is required by section 63(5) of the Climate Change Act 2008 to send a copy of the report to the Secretary of State to publish. This report must be sent as soon after preparation as is reasonable.

This Direction does not apply in respect of any devolved functions of the reporting authority.

This Direction does not apply in respect of any activities of the reporting authority which are: (i) outside of the United Kingdom; and (ii) which do not relate to any of its functions within the UK that are of a public nature or are part of its role as a statutory undertaker.

In preparing the report, the reporting authority is required by section 63(3) of the Climate Change Act 2008 to have regard to:

(a) the guidance issued by the Secretary of State under section 61 of the Climate Change Act 2008.

If the time between the issuing of any of the guidance or reports and the deadline for the report is very limited then it may be unreasonable to expect the guidance or reports to be taken into account. If so, the reporting authority should note that the requirement in section 63(3) of that Act to take these reports and guidance into account is qualified by the words "so far as relevant".

In preparing the report, if the reporting authority has functions that are exercisable in or as regards Wales or has devolved Welsh functions, then by section 63(4) of the Climate Change Act 2008 it must have regard so far as relevant to any guidance issued by the Welsh Ministers under section 66 of that Act and the most recent report under section 80 of that Act.

The reporting authority is required by section 63 (8) of the Climate Change Act 2008 to have regard to the report in exercising functions other than its devolved functions.

Compliance with this Direction is a statutory obligation (section 63(1) Climate Change Act 2008).

APPENDIX B

RESULTS OF UKCP09

OUTPUTS FROM UKCP09 FOR RISK SCREENING EXERCISE

Due to a lack of industry wide interpretation of UKCP09 data, Sutton and East Surrey Water has used it in a coarse manner to give an indication of climate change effects. The results of this interpretation have been used in the risk screening process only and have not been used in the detailed effect on the company's assets and operations.

Temperature

We are interested in knowing whether temperature will change and more importantly how the maximum temperature will change.

We considered the medium emissions scenario and looked at the temperature effects across the whole of our area. The output is shown in charts B1, B2 and B3.

Charts B1, B2 and B3 respectively show an increase in temperatures for virtually all probabilities. Looking at chart B3, which considers the summer maximum temperature, we have a 3 C temperature rise expected in the next 20 to 30 years.

Precipitation

We rely on precipitation in our area to refill the aquifers and rivers that we abstract from.

We considered the medium emissions scenario and looked at the precipitation effect across the whole of our area before narrowing in on specific areas (mainly based around where and when we abstract water). The output is shown in charts B4 through to B12.

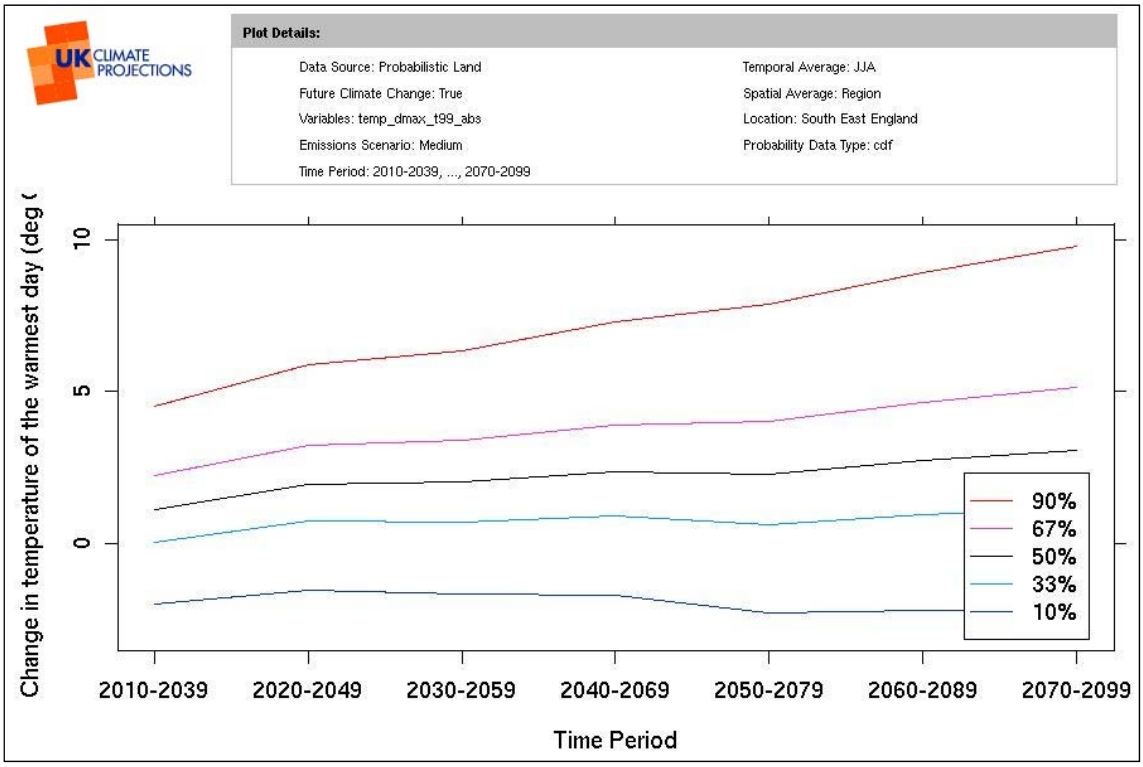
Chart B4 shows that when considering the whole of our area, there is little change in the precipitation when looking at the 50 percentile case. Charts B5 and B6 look at the summer and winter conditions and show that we can expect less precipitation in the summer and more precipitation in the winter.

Chart B7 shows a potential climate change opportunity for the company in the fact that there is more precipitation when we abstract from river intake B. However given the nature of the river this could lead to a negative (flooding).

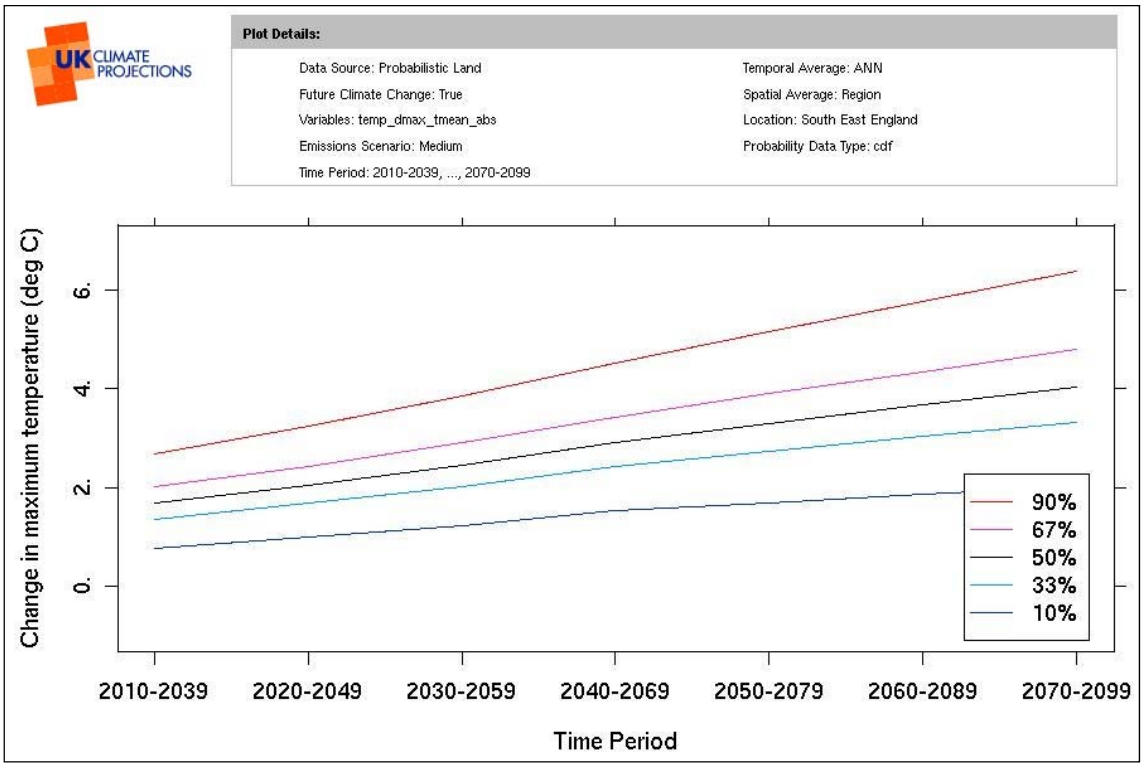
Charts B8 to B10 show how mean precipitation changes in areas that we abstract water from the ground. Of some concern is the reduction in precipitation from the area covered by our East and North West boreholes. The 50 percentile is showing a 2% reduction in precipitation levels in 100 years time.

Charts B11 and B12 underline the effect of changing precipitation seen in charts B5 and B6, that is, drier summers and wetter winters.

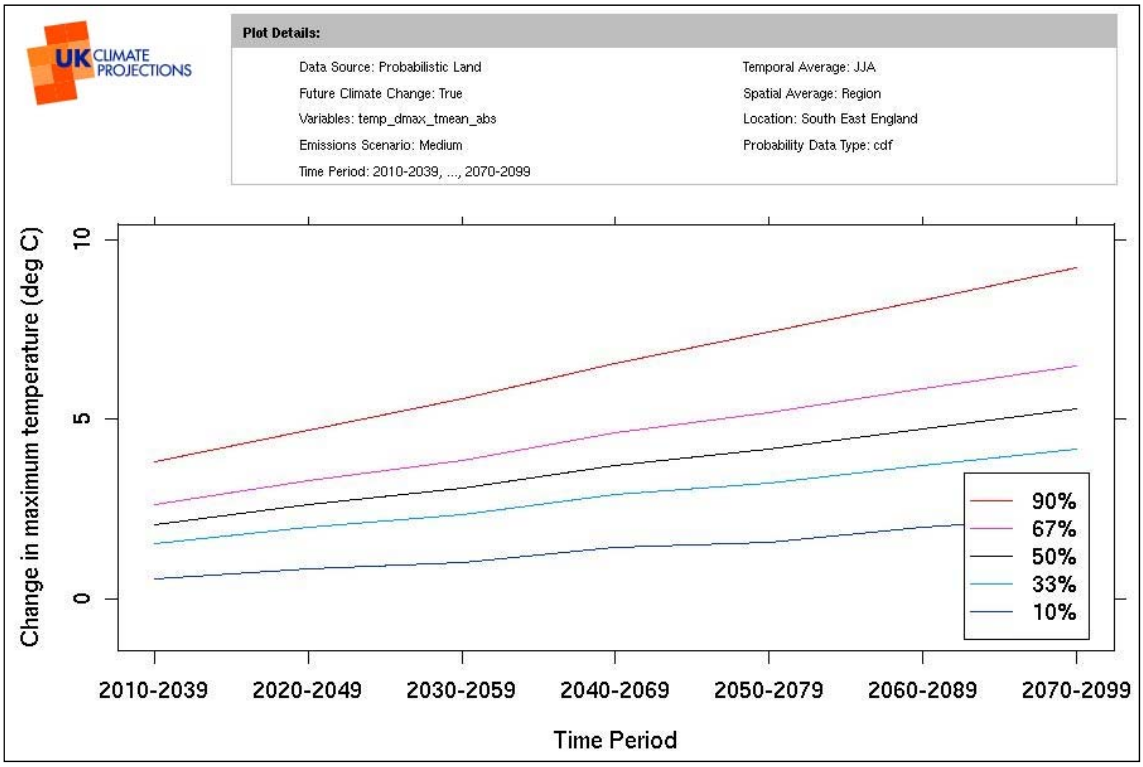
B.1 Maximum Temperature



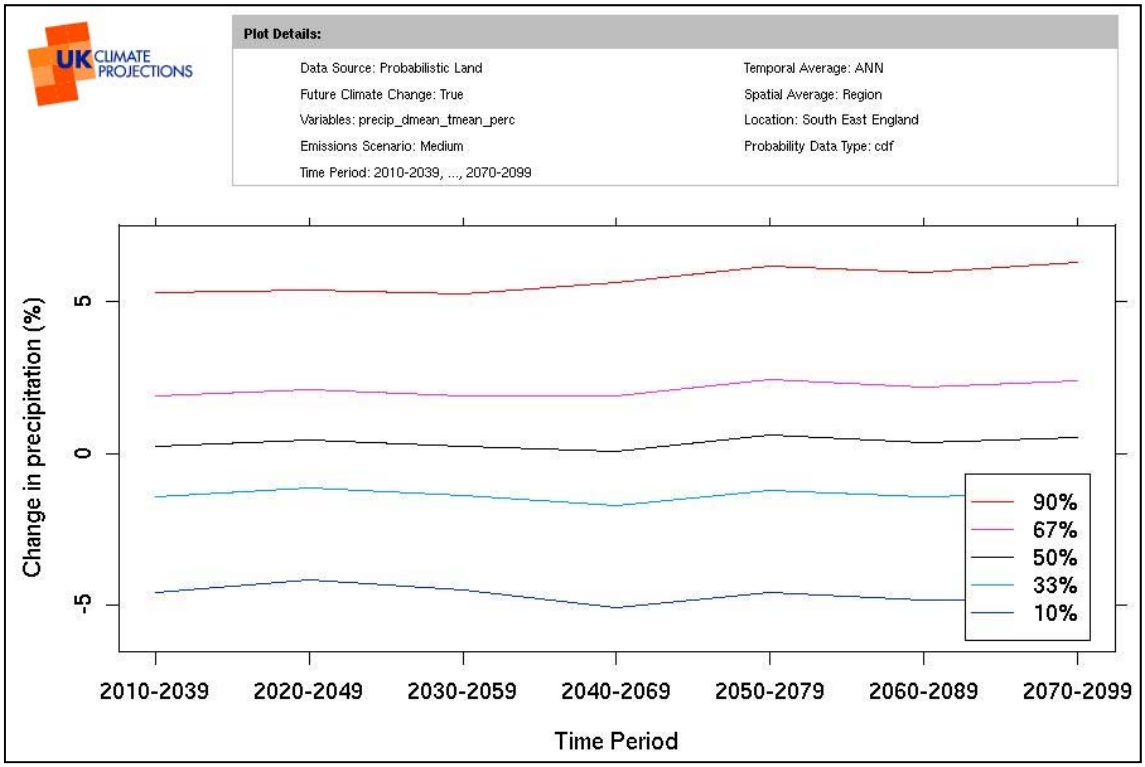
B.2 Mean Maximum Temperature



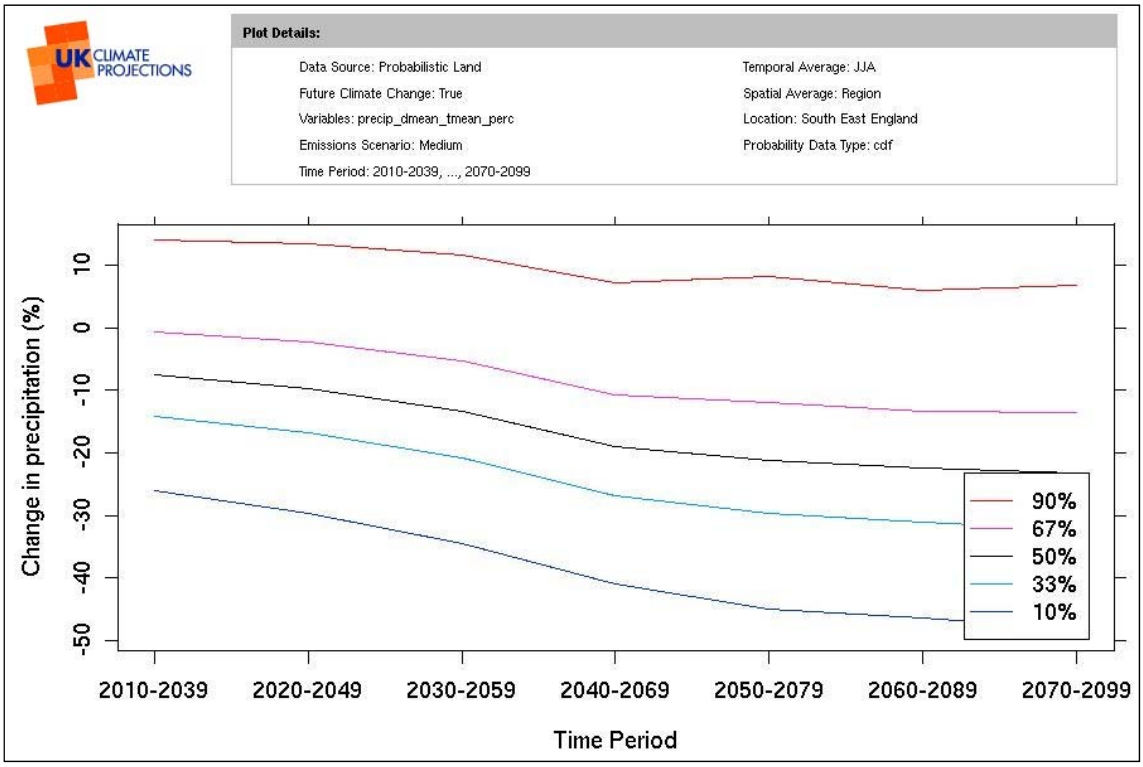
B.3 Summer Max Temperature



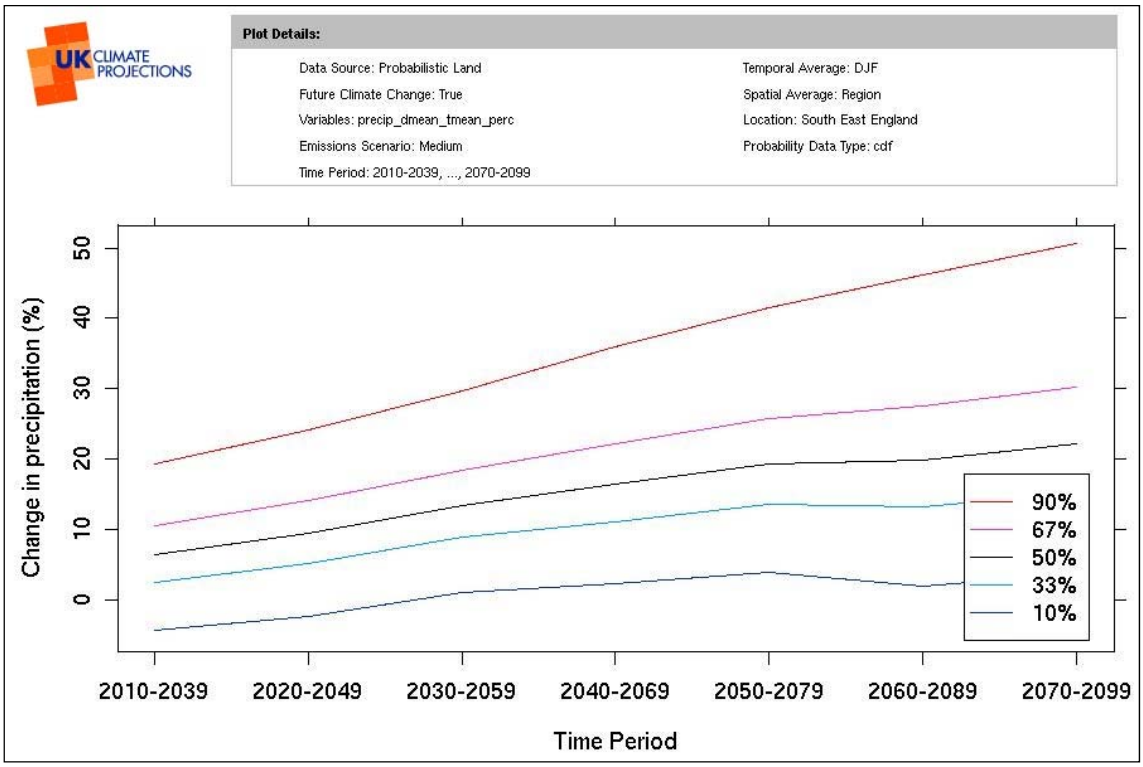
B.4 Annual Precipitation



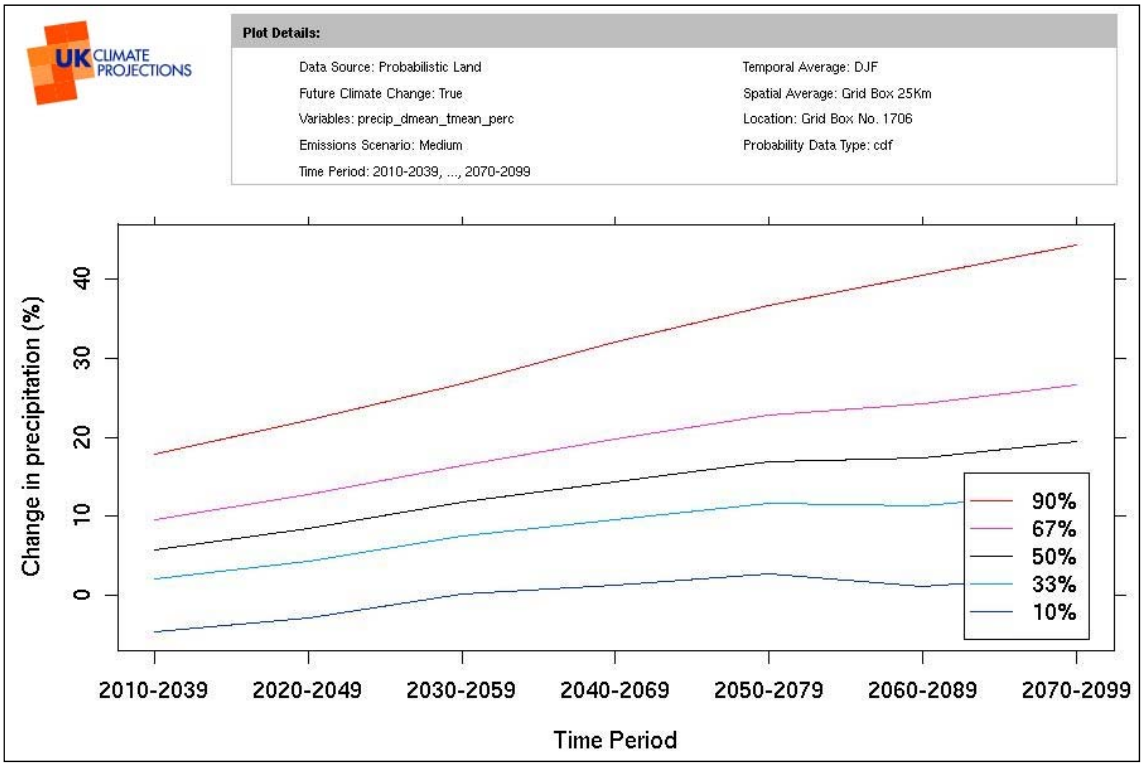
B.5 Mean Summer Precipitation



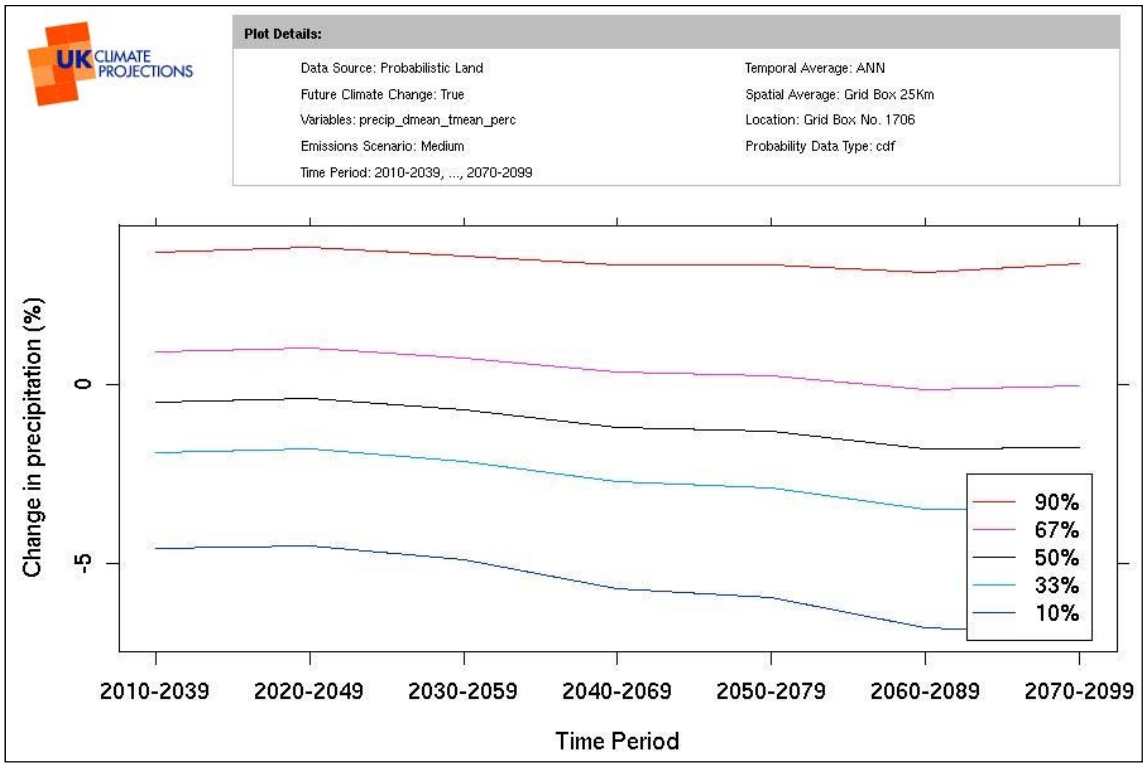
B.6 Mean Winter Precipitation



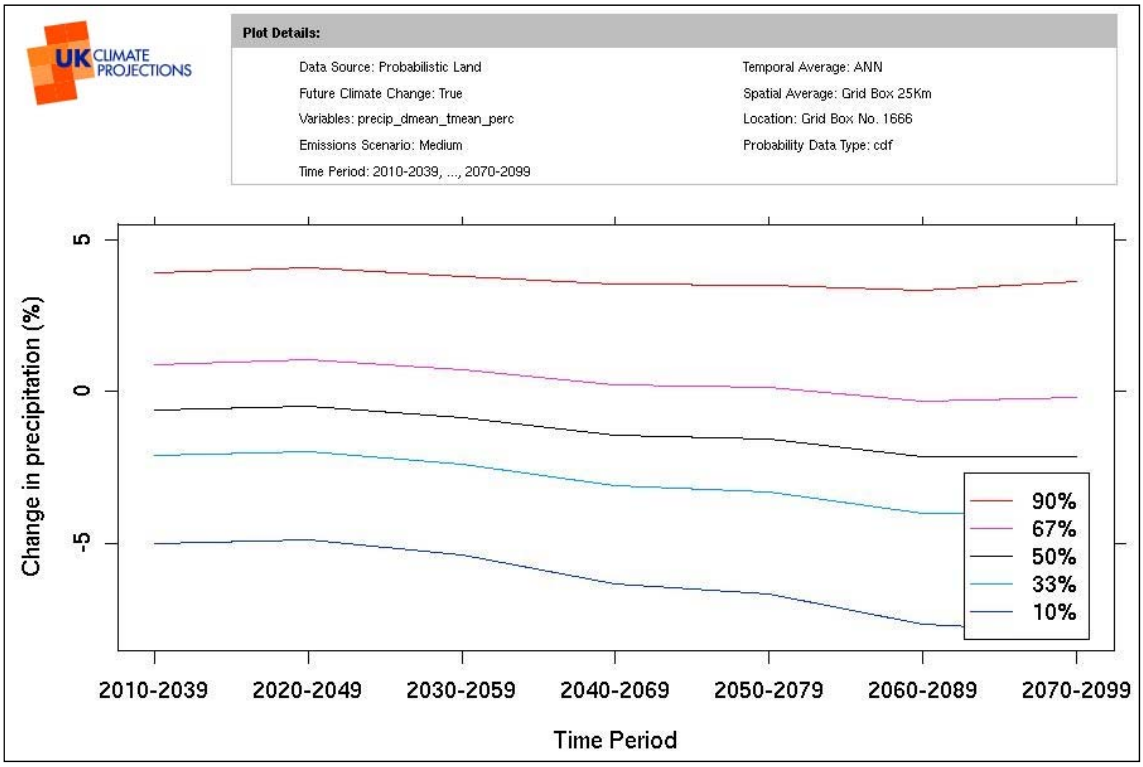
B.7 River Intake B – Winter Precipitation



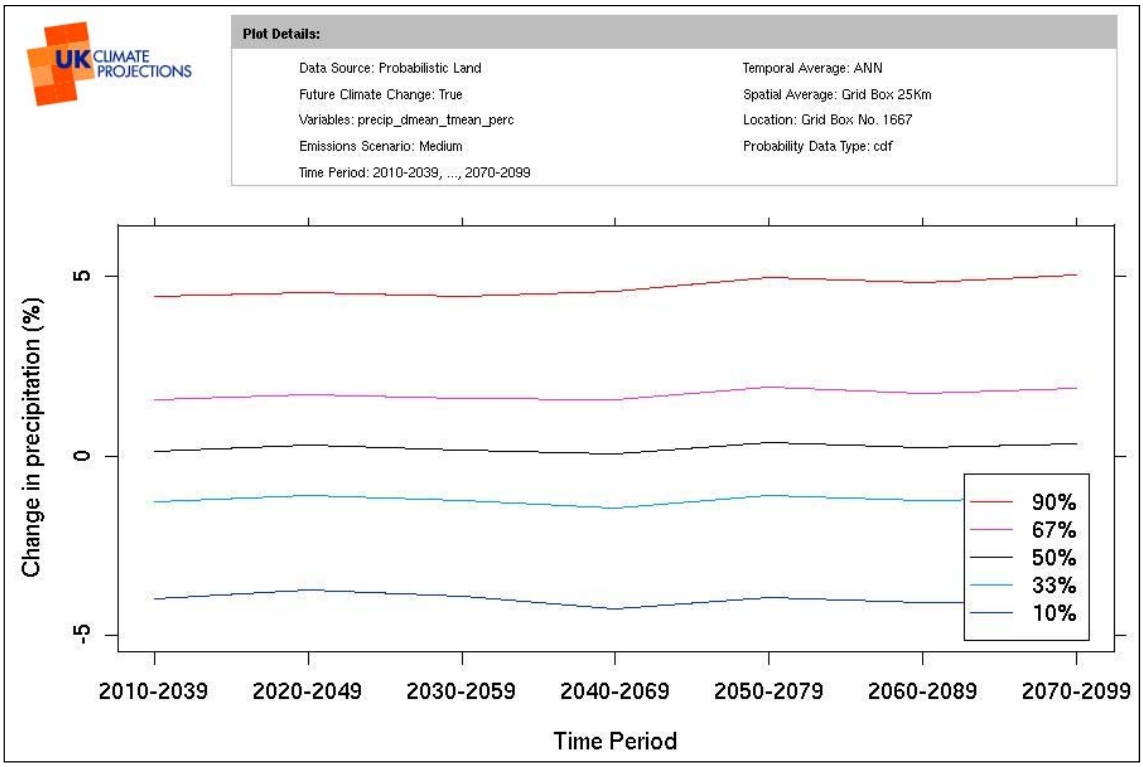
B.8 East Boreholes – Average Mean Precipitation



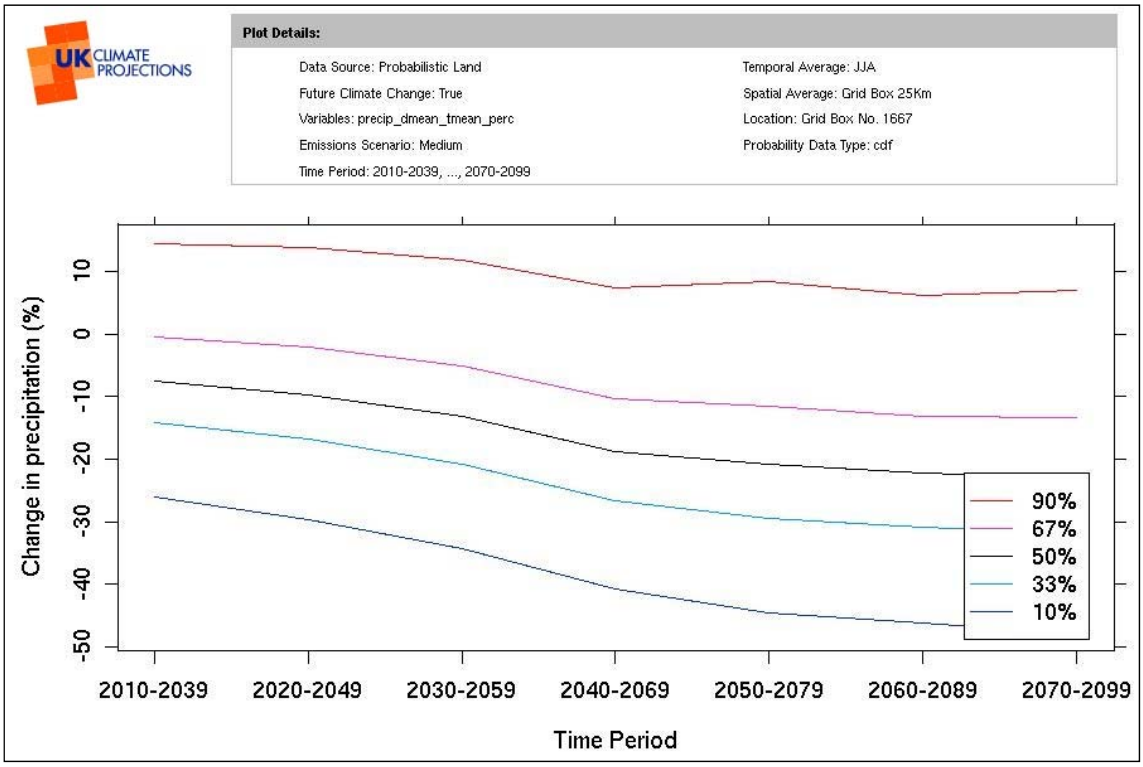
B.9 North West Boreholes – Average Mean Precipitation



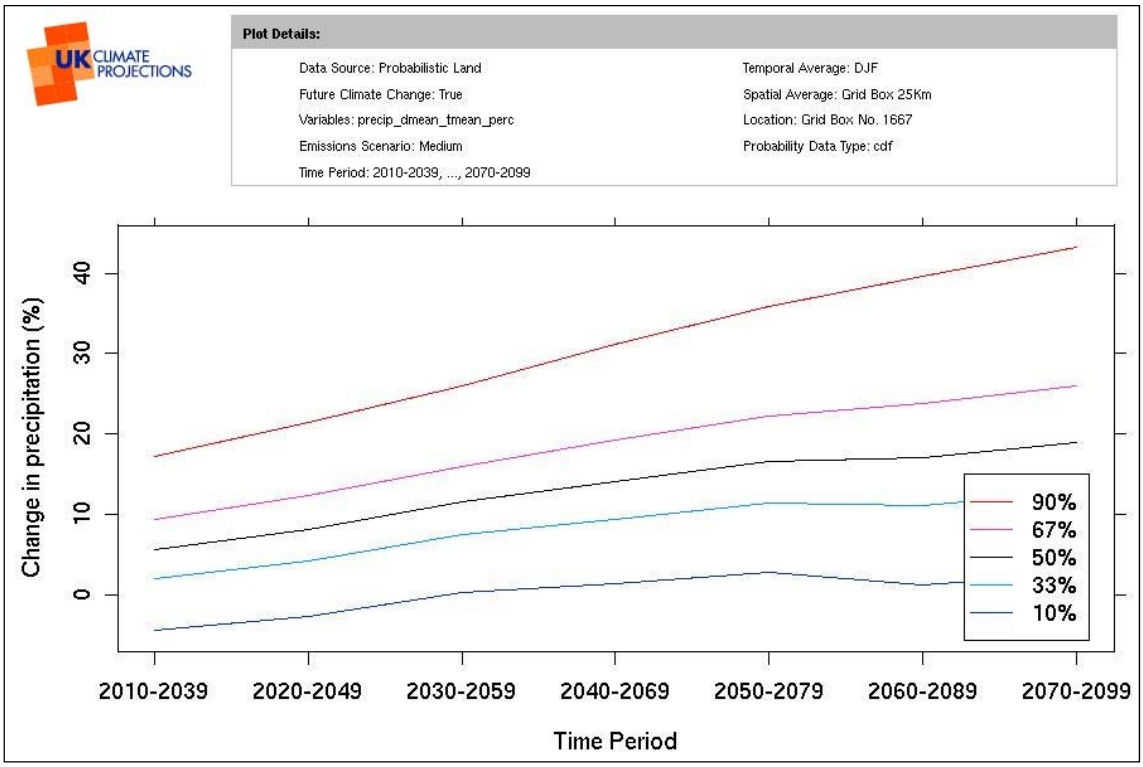
B.10 North Boreholes – Annual Mean Precipitation



B.11 North Boreholes – Mean Precipitation during Summer



B.12 North Boreholes – Mean Precipitation during Winter



APPENDIX C

CLIMATE CHANGE RISK SCREENING

Original Water UK Assessment on Effects of Climate Change (Sea Levels and Waste Water have been deleted)									SESW Specific Evaluation of Risk						
ASSET LEVEL 2	ASSET LEVEL 3	IMPACT REF.	IMPACT TYPE	RISK SCORE	PRESSURE...	CONSEQUENCE FOR ASSETS & OPERATIONS	CONSEQUENCE FOR SERVICE	ORIGINAL IMPACT DESCRIPTION	Likelihood	Consequence	Public	Scoring	Risk	Section	Comment
WATER RESOURCES	Boreholes / source pumping stations	D7	DROUGHT	3	Lower groundwater levels	Reducing borehole yields, reducing security of supply		Lower groundwater levels reduce borehole yields and causes a reduction in security of supply	4	4	4	64	VH	3.1 Water Resource Planning	Refer to water resource planning section
WATER RESOURCES	Storage Reservoirs & Aqueducts	T7	TEMP. RISE	1	Increased evapotranspiration,	Lower infiltration and borehole yields, reducing security of supply		Increased evaporation and evapotranspiration reduce yields, causing a reduction in security of supply	4	3	4	48	H	3.1 Water Resource Planning	Refer to water resource planning section
WATER RESOURCES	All Water Resources	T3	TEMP. RISE	1	Higher daily and peak domestic and commercial demand,	Reduced security of supply		Daily and peak domestic and commercial demand increases, causing a reduction in security of supply	4	4	3	48	H	3.1 Water Resource Planning	Refer to water resource planning section
WATER RESOURCES	Boreholes / source pumping stations	T9	TEMP. RISE	1	Increased evapotranspiration,	Lower infiltration and borehole yields, reducing security of supply		Increased evaporation and evapotranspiration reduce infiltration, and so borehole yields, causing a reduction in security of supply	3	4	4	48	H	3.1 Water Resource Planning	Refer to water resource planning section
WATER RESOURCES	Boreholes / source pumping stations	F8	FLOOD	3	More intense rainfall compacting upper soil layers,	More run-off, less recharge of aquifers, lower security of supply		More intense rainfall events compact upper soil layers, increasing run-off, reducing recharge of aquifers and reducing security of supply	3	4	4	48	H	3.1 Water Resource Planning	Refer to water resource planning section
WATER RESOURCES	All Water Resources	D4	DROUGHT	3	Lower river & borehole yields or reduced water quality,	Abstraction licences reduced or removed, reducing security of supply		Lower river yields, borehole yields or reduced water quality lead to abstraction licences being reduced or removed, causing a reduction in security of supply	3	4	4	48	H	3.1 Water Resource Planning	Refer to water resource planning section
WATER RESOURCES	All Water Resources	T6	TEMP. RISE	3	Higher temperatures	Security of supply	increasing customer sensitivity affecting security of supply	Increased customer sensitivity impacts security of supply	3	3	4	36	H	3.1 Water Resource Planning	Greater sensitivity leading to increase in operating costs.
WATER RESOURCES	All Water Resources	D1	DROUGHT	3	Reduced available supply	Reduced security of supply	pressure on water users	Reduced available supply causes political pressure for essential water users, e.g schools and hospitals, and for other customers reduces security of supply	3	4	3	36	H	3.1 Water Resource Planning	Refer to water resource planning section
WATER RESOURCES	All Water Resources	D2	DROUGHT	3	Higher daily & peak demand for garden watering,	Lower security of supply	[ ]	Daily & peak demand for 'garden' watering increases, causing a reduction in security of supply	4	3	3	36	H	3.1 Water Resource Planning	Known peak risk for SESW. See section dealing with water resource planning.
WATER RESOURCES	All Water Resources	F1	FLOOD	4	Direct asset flooding	Asset loss	service failure	Direct asset flooding causes service failure and asset loss	3	3	3	27	M	3.2 Flooding	Please refer to flooding section
WATER TREATMENT	All Water Treatment	F11	FLOOD	4	Direct asset flooding	Asset loss	service failure	Direct asset flooding causes service failure and asset loss	3	3	3	27	M	3.2 Flooding	Please refer to flooding section
SITE-WIDE SERVICES	SCADA & Telemetry	F52	FLOOD	3	Flooding	Loss of SCADA / telemetry	service failure	Flooding causes loss of SCADA and /or telemetry causing a service loss	3	3	3	27	M	3.2 Flooding	Loss of SCADA services is also discussed under Extrenal Infrastructure
WATER NETWORKS	Distribution storage	T22	TEMP. RISE	1	Higher peak demand	Leading to greater storage requirements reducing security of supply (??)		Increased peaks of demand lead to greater storage requirements reducing security of supply	2	4	3	24	M	3.1 Water Resource Planning	Known peak risk for SESW. See section dealing with water resoruce planning.
WATER RESOURCES	Storage Reservoirs & Aqueducts	F6	FLOOD	2	More intense rainfall events & changes to soil conditions	Slippage of soil dams, asset loss	service failure, customer flooding	More intense rainfall events & changes to soil conditions lead to the slippage of soil dams, causing service failure, customer flooding and asset loss	2	3	4	24	M	3.4.1 Impounding Reservoir	See impounding reservoir section.
WATER NETWORKS	All Water Networks	F17	FLOOD	4	Direct asset flooding	Asset loss	service failure	Direct asset flooding causes service failure and asset loss	2	3	4	24	M	3.2 Flooding	Please refer to section on flooding
SITE-WIDE SERVICES	All Site wide Services	D42	DROUGHT	4	Relocation of population from drought	Effecting supply-demand balance and other aspects		Relocation of permanent and tourist population from drought, temperature rise, flooding or sea level rise (impacts D2, T2, T3, T5, F3, S2) changes supply-demand balance. Response chosen (within WR) site wide services requirements.	2	4	3	24	M	3.1 Water Resource Planning	Unlikely to see an increase in tourist population. Growth allowed for in Water Resource Management Plan.
WATER TREATMENT	Service Reservoirs & Water Towers	F16	FLOOD	3	Direct flooding	Contaminants enter pipelines	higher drinking water quality risk	Direct flooding causes contaminants to enter pipelines, increasing drinking water quality risk	2	3	3	18	M	3.2 Flooding	Reservoirs based in area with low flood risk ie on top of a hill.
WATER NETWORKS	All Water Networks	F17 A	FLOOD	4	More frequent storms and power supply flooding,	Power outages	service failure	Increased storm frequency and power supply flooding increases frequency of power loss, causing service failure	2	3	3	18	M	3.3 External Infrastructure	Please refer to section on external infrastructure.
SLUDGE	All Sludge	F43	FLOOD	3	Direct asset flooding	Asset loss	service failure	Direct asset flooding causes service failure and asset loss	2	3	3	18	M	3.2 Flooding	Please refer to section on flooding
SITE-WIDE SERVICES	All Site wide Services	F48	FLOOD	3	Direct asset flooding	Asset loss	service failure	Direct asset flooding causes service failure and asset loss	2	3	3	18	M	3.2 Flooding	Please refer to section on flooding
SITE-WIDE SERVICES	All Site wide Services	F50	FLOOD	3	More frequent storms and power supply flooding,	power outages	service failure	Increased storm frequency and power supply flooding increases frequency of power loss, causing service failure	2	3	3	18	M	3.2 Flooding	Please refer to section on flooding
WATER RESOURCES	All Water Resources	D5	DROUGHT	3	Drier conditions	security of supply	increasing customer sensitivity to possibility of service failure, affecting security of supply	Increased customer sensitivity to possibility of service failure impacts security of supply.	3	2	3	18	M	3.1 Water Resource Planning	Potential for increased overtime to deal with routine emergencys which due to public concern lead to greater resources being deployed.
WATER TREATMENT	Service Reservoirs & Water Towers	D14	DROUGHT	3	Loss of supply and de-pressurisation	more frequent pipe failure	contamination of drinking water	Loss of supply and de-pressurisation of pipelines leads to greater incidence of pipe failure with resulting contamination increasing drinking water quality risk	2	2	3	12	L	See comment	Loss of supply and depressurisation of pipelines is a condition that exists due to pipe bursts. Existing resilience in place.
WATER NETWORKS	Distribution storage	T23	TEMP. RISE	1	Increased micro-biological growth,	Higher risk of residual chlorine depletion, contamination of supplies	higher drinking water quality risk	Increased rate of micro-biological growth increases risk of residual chlorine depletion and contamination of supplies, increasing drinking water quality risk	2	2	3	12	L	3.4.2 Water Quality	Water transferred over relatively short distances. SESW uses chloroamines rather than free chlorine.
WATER NETWORKS	Distribution networks incl. ancillaries	T21	TEMP. RISE	1	Increased micro-biological growth,	higher risk of residual chlorine depletion, contamination of supplies	higher drinking water quality risk	Increased rate of micro-biological growth increases risk of residual chlorine depletion and contamination of supplies, increasing drinking water quality risk	2	2	3	12	L	3.4.2 Water Quality	Water transferred over relatively short distances. SESW uses chloroamines rather than free chlorine.

Original Water UK Assessment on Effects of Climate Change (Sea Levels and Waste Water have been deleted)									SESW Specific Evaluation of Risk						
ASSET LEVEL 2	**ASSET LEVEL 3**	**IMPACT REF.**	**IMPACT TYPE**	**RISK SCORE**	**PRESSURE...**	**CONSEQUENCE FOR ASSETS & OPERATIONS**	**CONSEQUENCE FOR SERVICE**	**ORIGINAL IMPACT DESCRIPTION**	**Likelihood**	**Consequence**	**Public**	**Scoring**	**Risk**	**Section**	**Comment**
WATER RESOURCES	All Water Resources	T4	TEMP. RISE	1	Higher temperatures and longer growing season	redistribution of / increase in agricultural demand and impacts on security of supply		Higher temperatures and longer growing season causes redistribution of / increase in agricultural demand and impacts on security of supply	2	3	2	12	L	3.1 Water Resource Planning	Small percentage of company demand arises from agricultural use. Most of demand for agricultural is in dairy farming.
WATER RESOURCES	All Water Resources	T5	TEMP. RISE	1	Redistribution of permanent population with warmer conditions,		impacts on demand and security of supply	Redistribution of permanent population in response to temperature rise affects demand and impacts on security of supply	1	3	4	12	L	3.1 Water Resource Planning	Potential for relocation of permanent and tourist population to current area unlikely due to cost of land and planning constraints. Water resources plan allows for a certain level of growth within the population. Please refere to Water Resources Management Plan.
SITE-WIDE SERVICES	All Site wide Services	T55	TEMP. RISE	2	Higher levels of UV	higher risk of sun-related injury and illness		Higher levels of UV increase the risk of sun-related injury, endangering H&S of site staff	3	2	2	12	L	3.5.3 Personnel	SESW will adopt best practice guidance from HSE
SITE-WIDE SERVICES	All Site wide Services	T58	TEMP. RISE	1	Higher temperatures	increasing vegetation growth at sites		Higher temperatures cause increased vegetation growth at sites	3	2	2	12	L	See comment	Increased costs due to cutting of grass/vegetation. Potential for complaints from customers if grass not cut.
WATER TREATMENT	All Water Treatment	G1	GENERAL	4	Relocation of population from weather, flooding, sea level rise	affecting supply-demand balance, treatment works, asset capacity etc		Relocation of permanent and tourist population from drought, temperature rise, flooding or sea level rise (impacts D2, T2, T3, T5, F3, S2) changes supply-demand balance. Response chosen (within WR) impacts WTW requirements and capacity needed.	1	3	4	12	L	3.1 Water Resource Planning	Potential for relocation of permanent and tourist population to current area unlikely due to cost of land and planning constraints. Water resources plan allows for a certain level of growth within the population. Please refere to Water Resources Management Plan.
WATER NETWORKS	All Water Networks	G2	GENERAL	4	Relocation of population from weather, flooding, sea level rise	affecting supply-demand balance, network capacity etc		Relocation of permanent and tourist population from drought, temperature rise, flooding or sea level rise (impacts D2, T2, T3, T5, F3, S2) changes supply-demand balance. Response chosen (within WR) impacts water networks requirements and capacity needed.	1	3	4	12	L	3.1 Water Resource Planning	Potential for relocation of permanent and tourist population to current area unlikely due to cost of land and planning constraints. Water resources plan allows for a certain level of growth within the population. Please refere to Water Resources Management Plan.
SLUDGE	All Sludge	G5	GENERAL	4	Relocation of population from weather, flooding, sea level rise	affecting supply-demand balance, treatment, asset capacity etc		Relocation of permanent and tourist population from drought, temperature rise, flooding or sea level rise (impacts D2, T2, T3, T5, F3, S2) changes supply-demand balance. Response chosen (within WR) impacts sludge treatment, storage and disposal requirements and capacity needed.	1	3	4	12	L	3.1 Water Resource Planning	Potential for relocation of permanent and tourist population to current area unlikely due to cost of land and planning constraints. Water resources plan allows for a certain level of growth within the population. Please refere to Water Resources Management Plan.
WATER TREATMENT	All Water Treatment	F12	FLOOD	4	More frequent storms and power supply flooding,	power outages	service failure	Increased storm frequency increases frequency of power loss, causing service failure	2	3	2	12	L	3.3 External Infrastructure	This is a low risk but has been expanded upon in main body of report to explain why for SESW this would be a low consequence
WATER RESOURCES	All Water Resources	F2	FLOOD	4	More frequent storms and power supply flooding,	power outages	service failure	Increased storm frequency and power supply flooding increases frequency of power loss, causing service failure	2	2	3	12	L	3.3 External Infrastructure	This is a low risk but has been expanded upon in main body of report to explain why for SESW this would be a low consequence
WATER RESOURCES	Storage Reservoirs & Aqueducts	F7	FLOOD	2	More intense rainfall events	overwhelming spillways, asset loss	service failure, customer flooding	More intense rainfall events exceed capacity of spillways to deal with increased storm intensity, causing service failure, customer flooding and asset loss	1	3	4	12	L	See comment	Unlikely to happen with SESW assets. Impounding reservoir has water pumped into it.
WATER NETWORKS	Distribution pumping stations	D21	DROUGHT	4	Loss of supply and depressurisation of the supply network,	more air blockages and service failure	service failure	Loss of supply and de-pressurisation of the supply system leads to greater incidence of air blockages, causing service failure	2	3	2	12	L	See comment	Unlikely to happen with SESW assets. Pumping stations fed from elevated reservoirs.
WATER RESOURCES	All Water Resources	D3	DROUGHT	3	Intake, borehole pump and reservoir draw-off levels do not match reduced levels		service failure	Intake, borehole pump and reservoir draw-off levels do not match reduced levels causing service failure	3	2	2	12	L	3.1 Water Resource Planning	Not an issue with intake and reservoir draw offs. Changing borehole levels lead to an increased cost of pumping and may lead to borehole pumps being changed.
WATER NETWORKS	All Water Networks	D17	DROUGHT	3	Higher daily & peak demand for garden watering,	increased asset use, faster asset deterioration		Daily & peak demand for 'garden' watering increases, increasing asset use and causing accelerated asset deterioration	3	2	2	12	L	3.1 Water Resource Planning	Known peak risk for SESW. Assets designed to accommodate this.
WATER RESOURCES	Storage Reservoirs & Aqueducts	D6	DROUGHT	3	Lower river flows	lower yields, increasing demand on existing storage, reducing in security of supply		Lower river flows reduce yields and hence increased demand on existing storage, and causes a reduction in security of supply	1	3	4	12	L	3.1 Water Resource Planning	Unlikely to effect SESW. Water abstracted from river due winter months. UKCP09 predicting greater precipitation during winter months
WATER NETWORKS	Distribution networks incl. ancillaries	F19	FLOOD	3	Direct flooding	Contaminants enter pipelines	higher drinking water quality risk	Direct flooding causes contaminants to enter pipelines, increasing drinking water quality risk	1	3	3	9	L	3.2 Flooding	Pipes under positive presssure and therefore low risk of contamination.
WATER RESOURCES	Storage Reservoirs & Aqueducts	T8	TEMP. RISE	1	Increased evapotranspiration	lower surface reservoirs yields; greater reliance on groundwater recharge, reducing security of supply		Increased evaporation and evapotranspiration reduces yield of surface reservoirs and increases demand on groundwater recharge, causing a reduction in security of supply	1	3	3	9	L	3.1 Water Resource Planning	Please refer to water resource planning section.
WATER TREATMENT	Service Reservoirs & Water Towers	F15	FLOOD	3	Direct flooding	contaminants enter underground storage tanks	higher drinking water quality risk	Direct flooding causes contaminants to enter underground storage tanks increasing drinking water quality risk	1	3	3	9	L	3.2 Flooding	Aboveground service reservoirs and towers. Please refer to section on flooding
WATER NETWORKS	Distribution networks incl. ancillaries	F18	FLOOD	4	Flooding	infiltration into pipelines	increasing drinking water quality risk	Flood water infiltration into pipelines increases drinking water quality risk	1	3	3	9	L	3.2 Flooding	Historically low levels of leakage from pipes and therefore low risk of contaminants entering supply pipes
WATER NETWORKS	Distribution storage	F20	FLOOD	3	Direct flooding	contaminants enter underground storage tanks	higher drinking water quality risk	Direct flooding causes contaminants to enter underground storage tanks increasing drinking water quality risk	1	3	3	9	L	See comment	Service reservoirs are built in elevated positions with little chance of flooding and are only partially below ground level.

Original Water UK Assessment on Effects of Climate Change (Sea Levels and Waste Water have been deleted)									SESW Specific Evaluation of Risk						
ASSET LEVEL 2	**ASSET LEVEL 3**	**IMPACT REF.**	**IMPACT TYPE**	**RISK SCORE**	**PRESSURE...**	**CONSEQUENCE FOR ASSETS & OPERATIONS**	**CONSEQUENCE FOR SERVICE**	**ORIGINAL IMPACT DESCRIPTION**	**Likelihood**	**Consequence**	**Public**	**Scoring**	**Risk**	**Section**	**Comment**
SITE-WIDE SERVICES	All Site wide Services	F49	FLOOD	4	Direct asset flooding	reduced access to assets; H&S risk for site staff		Direct asset flooding cuts access to assets, endangering H&S of site staff	3	3	1	9	L	3.2 Flooding	Please refer to section on flooding
WATER TREATMENT	Service Reservoirs & Water Towers	D13	DROUGHT	3	Loss of / intermittent supply	increases risk of external contaminants entering supply pipelines		Loss of / intermittent supply increases risk of contamination from external contaminants entering the pipelines, increasing drinking water quality risk	1	3	3	9	L	See comment	Procedures and resilience in place for dealing with this eventuality
WATER TREATMENT	Treated water pumping stations	D16	DROUGHT	4	Loss of supply and depressurisation of the supply network,	more air blockages	service failure	Loss of supply and depressurisation of the supply system leads to greater incidence of air blockages, causing service failure	1	3	3	9	L	See comment	Procedures and resilience in place for dealing with this eventuality
WATER NETWORKS	Distribution networks incl. ancillaries	D19	DROUGHT	4	Loss of supply and depressurisation of the supply network,	more frequent pipe failure	contamination of drinking water	Loss of supply and de-pressurisation of pipelines leads to greater incidence of pipe failure, and resulting contamination during re-pressurisation increases drinking water quality risk	1	3	3	9	L	See comment	Procedures and resilience in place for dealing with this eventuality. Extreme weather (cold) from climate change more likely to pipes in ground.
WATER NETWORKS	Distribution networks incl. ancillaries	D18	DROUGHT	4	Loss of / intermittent supply	increased risk of external contaminants entering supply pipelines	contamination of drinking water	Loss of supply or intermittent supplies increases risk of external contaminants entering the pipelines, increasing drinking water quality risk	2	2	2	8	L	See comment	Loss of supply and depressurisation of pipelines is a condition that exists due to pipe bursts. Existing resilience in place.
WATER TREATMENT	Treatment works	T14	TEMP. RISE	1	More frequent disease increasing drinking water quality risk	additional potable water standards		Increased incidence of disease leads to introduction of additional potable standards, increasing drinking water quality risk	1	4	2	8	L	3.4.2 Water Quality	Please refer to water quality section.
WATER TREATMENT	Service Reservoirs & Water Towers	T18	TEMP. RISE	1	More extreme wetting and drying cycles	greater soil movement, more pipe movement and bursts		Greater extremities in wetting and drying cycles lead to greater soil movement, causing pipe systems to move increasing burst frequency	2	2	2	8	L	See comment	This would lead to greater costs for repair. Systems in place for monitoring leakage from reservoirs and towers.
WATER NETWORKS	Distribution networks incl. ancillaries	T20	TEMP. RISE	1	More extreme wetting and drying cycles	greater soil movement, more pipe movement and bursts		Greater extremities in wetting and drying cycles lead to greater soil movement, causing pipe systems to move increasing burst frequency	2	2	2	8	L	See comment	This would lead to greater costs for leakage detection and repair. Systems in place for monitoring burst frequency.
SLUDGE	All Sludge	F44	FLOOD	3	More frequent storms and power supply flooding,	power outages	service failure	Increased storm frequency increases frequency of power loss, causing service failure	2	2	2	8	L	3.3 External Infrastructure	Please refer to section on external infrastructure.
WATER NETWORKS	Distribution networks incl. ancillaries	D20	DROUGHT	4	Loss of / intermittent supply	increases risk of mechanical asset failure (eg in PRVs)	service failure	Loss of supply or intermittent supplies leads to increased risk of mechanical asset failure in PRV's, PSV's, Actuated Valves causing service loss	2	2	2	8	L	See comment	This condition exists for burst mains and therefore existing resilience in place for dealing with this eventuality.
WATER RESOURCES	Raw water pipelines	F9	FLOOD	4	Flooding	infiltration into pipelines	increasing drinking water quality risk	Flood water infiltration into pipelines increases drinking water quality risk	1	2	3	6	VL	3.2 Flooding	Raw water pipelines under positive pressure and therefore will leak out rather than allow contaminated water in.
SLUDGE	All Sludge	T49	TEMP. RISE	2	Higher average and peak temperatures		greater incidence of water & wetland associated disease	Higher average and peak temperatures cause an increase in incidence of sludge related disease	1	2	3	6	VL	See comment	Most of company sludge is chalk based.
SITE-WIDE SERVICES	All Site wide Services	T56	TEMP. RISE	2	Higher average and peak temperatures		greater incidence of water & wetland associated disease	Higher average and peak temperatures cause an increase in incidence of water & wetland associated disease	1	2	3	6	VL	See comment	Unlikely to effect SESW
SLUDGE	Sludge disposal or re-cycling	T52	TEMP. RISE	3	Agricultural practice change		agricultural demand for sludge	Agricultural practice change affects agricultural demand for sludge	2	3	1	6	VL	See comment	Potential additional revenue resource for the Company
WATER TREATMENT	Treatment works	F13	FLOOD	1	More intense rainfall events		discolouration and odour problems for drinking water (through biological consequences)	Discolouration and odour problems caused by the biological consequences of more intense rainfall events increase drinking water quality risk	1	2	3	6	VL	3.4.2 Water Quality	Please refer to section on water quality.
SITE-WIDE SERVICES	All Site wide Services	F51	FLOOD	4	Direct flooding of electrical assets,	risk to staff of electrocution		Direct flooding leads to submersion of electrical assets, increasing risk to operatives of electrocution endangering H&S of site staff	2	3	1	6	VL	3.2 Flooding	Please refer to section on flooding
SLUDGE	Sludge disposal or re-cycling	D39	DROUGHT	3	Agricultural practice change		agricultural demand for sludge	Agricultural practice change affects sludge demand and affects agricultural demand for sludge	2	3	1	6	VL	See comment	This would lead to an increase in costs since the company would have to find alternative outlets for sludge.
WATER TREATMENT	Treatment works	T12	TEMP. RISE	1	Higher temperatures	lower raw water quality	greater risk to drinking water quality	Higher temperatures reduce raw water quality and increase drinking water quality risk	1	2	2	4	VL	See comment	Unlikely. Existing standards lead to a high level of treatment and hence carbon emissions. Increased standards would aggrevate climate change.
WATER TREATMENT	Treatment works	F14	FLOOD	3	Increased runoff	higher sediment levels	higher drinking water quality risk	Increased runoff leads to greater sediment levels, which increases drinking water quality risk	1	2	2	4	VL	3.4.2 Water Quality	Increased run off may lead to greater pesticide concentrations in local water courses. Existing resilience in place.
WATER RESOURCES	Storage Reservoirs & Aqueducts	F5	FLOOD	1	Increased soil erosion	siltation of dams, accelerating asset deterioration		Increased soil erosion causes the siltation of dams, causing accelerated asset deterioration and asset loss	1	4	1	4	VL	See comment	Impounding reservoir not directly fed by river.
WATER NETWORKS	Distribution storage	D22	DROUGHT	3	Lower flow rates	deposition, reducing raw water quality		Lower flow rates cause deposition leading to reduced raw water quality.	1	2	2	4	VL	See comment	Historically low levels of deposition of sediment in service reservoirs.
WATER RESOURCES	All Water Resources	F4	FLOOD	1	The threat of assets being flooded		higher customer expectations for visible hard engineering adaptation solutions	The threat of treatment works being flooded (with subsequent service loss) increases customer expectations for visible hard engineering adaptation solutions	1	1	3	3	VL	3.2 Flooding	Obvious risk to treatment works is low. Please refer to flooding section
WATER TREATMENT	All Water Treatment	D10	DROUGHT	4	Low flows	lead to greater sedimentation & blockages	service failure	Low flows lead to greater sedimentation, with blockages causing service failure	1	1	3	3	VL	See comment	Historically low levels of deposition of sediment in service reservoirs.
WATER TREATMENT	Treatment works	D11	DROUGHT	3	Reduced raw water volumes reducing dilution		increase drinking water quality risk	Reduced raw water volumes reduce dilution and increase drinking water quality risk	1	1	3	3	VL	See comment	This is unlikely to affect the Company.

Original Water UK Assessment on Effects of Climate Change (Sea Levels and Waste Water have been deleted)									SESW Specific Evaluation of Risk						
ASSET LEVEL 2	**ASSET LEVEL 3**	**IMPACT REF.**	**IMPACT TYPE**	**RISK SCORE**	**PRESSURE...**	**CONSEQUENCE FOR ASSETS & OPERATIONS**	**CONSEQUENCE FOR SERVICE**	**ORIGINAL IMPACT DESCRIPTION**	**Likelihood**	**Consequence**	**Public**	**Scoring**	**Risk**	**Section**	**Comment**
WATER TREATMENT	Service Reservoirs & Water Towers	D12	DROUGHT	3	Intermittency in supply	silt and debris accumulating in service reservoirs and towers	higher drinking water quality risk	Loss of / intermittent supply increases risk of contamination from accumulated silt and debris being flushed out of service reservoirs and towers, increasing drinking water quality risk	1	1	3	3	VL	See comment	Regular cleaning of reservoirs and towers in place. Historically little sedimentation found in reservoirs and towers
WATER NETWORKS	Distribution storage	D23	DROUGHT	3	Loss of supply or intermittent supplies	contamination from accumulated silt and debris being flushed out of service reservoirs and towers	higher drinking water quality risk	Loss of supply or intermittent supplies leads to contamination from accumulated silt and debris being flushed out of service reservoirs and towers, increasing drinking water quality risk	1	1	3	3	VL	See comment	Regular cleaning of reservoirs and towers in place. Historically little sedimentation found in reservoirs and towers
WATER TREATMENT	Treatment works	T15	TEMP. RISE	1	Higher temperatures		discolouration and odour problems for drinking water (through biological consequences)	Discolouration and odour problems caused by the biological consequences of higher temperatures increase drinking water quality risk	1	1	2	2	VL	3.4.2 Water Quality	Please refer to section on water quality.
WATER TREATMENT	Service Reservoirs & Water Towers	T16	TEMP. RISE	1	Increased micro-biological growth,	higher risk of residual chlorine depletion, contamination of supplies	higher drinking water quality risk	Increased rate of micro-biological growth increases risk of residual chlorine depletion and contamination of supplies, increasing drinking water quality risk	1	1	2	2	VL	See comment	SESW uses chloroamines rather than free chlorine.
WATER TREATMENT	Service Reservoirs & Water Towers	T17	TEMP. RISE	1	Increased micro-biological growth,	higher risk of residual chlorine depletion, contamination of supplies	higher drinking water quality risk	Increased rate of micro-biological growth increases risk of residual chlorine depletion and contamination of supplies, increasing drinking water quality risk	1	1	2	2	VL	See comment	SESW uses chloroamines rather than free chlorine.
WATER RESOURCES	All Water Resources	F3	FLOOD	1	Movement of permanent population (eg away from flood plains) and tourism due to flooding,		impacts on demand and security of supply	Flooding in certain areas causes redistribution of permanent population (eg away from flood plains) and tourism, which affects demand and impacts on security of supply	1	2	1	2	VL	3.1 Water Resource Planning	Area is unlikely to see population decrease. No significant rivers flow through company area.
WATER TREATMENT	Service Reservoirs & Water Towers	D15	DROUGHT	3	Inversions occur more frequently with low water levels;	Cryptosporidium accumulation	higher drinking water quality risk	Inversions occur more frequently in incidences of low water levels; Cryptosporidium accumulation issues increase drinking water quality risk	1	1	2	2	VL	See comment	Sites with known cryptospiridium risk have now got UV disinfection. System in place for stopping inversions in reservoirs
SLUDGE	Sludge treatment	D38	DROUGHT	3	More dust,	accelerated asset deterioration; impacts on H&S of staff		Increase in the generation of dust causes accelerated asset deterioration and endangers H&S of site staff	1	1	2	2	VL	See comment	SESW sludge unlikely to produce significant quantities of dust
WATER RESOURCES	Raw water pipelines	D8	DROUGHT	3	Lower flow rates	deposition; reduced raw water quality		Lower flow rates cause deposition leading to reduced raw water quality	1	2	1	2	VL	See comment	85% of water comes from borehole sources. 15% abstracted from river during winter months only
WATER RESOURCES	All Water Resources	T1	TEMP. RISE	1	Higher average and peak temperatures	accelerated deterioration of structures, buildings, machinery, equipment		Higher average and peak temperatures affect structures, buildings, H & V, MEICA plant working life, causing accelerated asset deterioration	1	1	1	1	VL	3.4.4 Mechanical and Electrical Assets	M&E asset life of 25 years. Over next 25 years, standards for equipment will be revised leading to different equipment being specified eg tropicalised motors.
WATER TREATMENT	All Water Treatment	T10	TEMP. RISE	1	Higher temperatures	more algal growth and micro-organisms in the water supply system	higher drinking water quality risk	Increased algal growth and risk of microscopic organisms within the water supply system increases drinking water quality risk	1	1	1	1	VL	3.4.2 Water Quality	Little risk given current treatment levels.
WATER TREATMENT	All Water Treatment	T11	TEMP. RISE	1	Higher average and peak temperatures	accelerated deterioration of structures, buildings, machinery, equipment		Higher average and peak temperatures affect structures, buildings, H & V, MEICA plant working life, causing accelerated asset deterioration	1	1	1	1	VL	3.4.4 Mechanical and Electrical Assets	M&E asset life of 25 years. Over next 25 years, standards for equipment will be revised leading to different equipment being specified eg tropicalised motors.
WATER TREATMENT	Treatment works	T13	TEMP. RISE	1	Higher temperatures	impacts on treatment process	improving treated water quality	Higher temperatures impact treatment process improving treated water quality	1	1	1	1	VL	3.4.2 Water Quality	Most of water is from borehole sources which have a constant temperature
WATER NETWORKS	All Water Networks	T19	TEMP. RISE	1	Higher average and peak temperatures	accelerated deterioration of structures, buildings, machinery, equipment		Higher average and peak temperatures affect structures, buildings, H & V, MEICA plant working life, causing accelerated asset deterioration	1	1	1	1	VL	3.4.4 Mechanical and Electrical Assets	M&E asset life of 25 years. Over next 25 years, standards for equipment will be revised leading to different equipment being specified eg tropicalised motors.
WATER RESOURCES	All Water Resources	T2	TEMP. RISE	1	Redistribution of / increase in tourism	reduced security of supply	increased seasonal demand,	Redistribution of / increase in tourism increases seasonal demand and causes a reduction in security of supply	1	1	1	1	VL	3.1 Water Resource Planning	Area supplied is not a known tourist area
SLUDGE	All Sludge	T50	TEMP. RISE	1	Higher average and peak temperatures	accelerated deterioration of structures, buildings, machinery, equipment		Higher average and peak temperatures affect structures, buildings, H & V, MEICA plant working life, causing accelerated asset deterioration	1	1	1	1	VL	3.4.4 Mechanical and Electrical Assets	M&E asset life of 25 years. Over next 25 years, standards for equipment will be revised leading to different equipment being specified eg tropicalised motors.
SLUDGE	Sludge treatment	T51	TEMP. RISE	3	Higher average temperatures	less heating requirement for sludge digestion		Higher average temperatures reduce heating requirement for sludge digestion and affects performance	1	1	1	1	VL	See comment	Not applicable to SESW
SLUDGE	Sludge disposal or re-cycling	T53	TEMP. RISE	2	Higher temperatures	greater microbial action, increased gas production and risk of ignition, endangering staff		Higher temperatures lead to greater microbial action, and increased gas production and risk of ignition in storage endangers H&S of site staff	1	1	1	1	VL	See comment	Not applicable to SESW
SLUDGE	Sludge disposal or re-cycling	T54	TEMP. RISE	2	Higher temperatures	increased insect problems		Higher temperatures lead to increased insect issues and create an environmental health risk	1	1	1	1	VL	See comment	Not applicable to SESW
SITE-WIDE SERVICES	All Site wide Services	T57	TEMP. RISE	1	Higher average and peak temperatures	accelerated deterioration of structures, buildings, machinery, equipment		Higher average and peak temperatures affect structures, buildings, H & V, MEICA plant working life, causing accelerated asset deterioration	1	1	1	1	VL	3.4.4 Mechanical and Electrical Assets	M&E asset life of 25 years. Over next 25 years, standards for equipment will be revised leading to different equipment being specified eg tropicalised motors.
WATER RESOURCES	Intake Pumping stations	F10	FLOOD	3	More storm water,	increased pump usage & accelerated asset deterioration		Greater volumes of storm water cause increased pumping where pumps are part of the infrastructure, leading to increased asset usage and accelerated asset deterioration	1	1	1	1	VL	3.2 Flooding	Unlikely to effect SESW assets. Potential for flooding at Intake area covered by Flooding section
SLUDGE	Sludge disposal or re-cycling	F45	FLOOD	3	Flooding prevents access to fields		service failure	Flooding prevents access to fields causing service failure	1	1	1	1	VL	See comment	Sludge irregularly removed from treatment works

Original Water UK Assessment on Effects of Climate Change (Sea Levels and Waste Water have been deleted)									SESW Specific Evaluation of Risk						
ASSET LEVEL 2	**ASSET LEVEL 3**	**IMPACT REF.**	**IMPACT TYPE**	**RISK SCORE**	**PRESSURE...**	**CONSEQUENCE FOR ASSETS & OPERATIONS**	**CONSEQUENCE FOR SERVICE**	**ORIGINAL IMPACT DESCRIPTION**	**Likelihood**	**Consequence**	**Public**	**Scoring**	**Risk**	**Section**	**Comment**
SLUDGE	Sludge disposal or re-cycling	F46	FLOOD	3	Flooding of sludge transport routes		service failure	Flooding cuts sludge transport routes causing service failure	1	1	1	1	VL	See comment	Sludge irregularly removed from treatment works
SLUDGE	Sludge disposal or re-cycling	F47	FLOOD	3	Increased runoff from sludge-treated agricultural land		reducing receiving water quality	Increased run off rates from sludge treated agricultural land reduce receiving water quality	1	1	1	1	VL	See comment	Unlikely from sludge. Potential concern from pesticide run off.
SLUDGE	All Sludge	D37	DROUGHT	3	Change in domestic waste disposal	change in dry weather flow pollutants & composition of sludge		Change in domestic waste disposal patterns leads to change in dry weather flow pollutants affecting composition of sludge	1	1	1	1	VL	See comment	More relevant to waste water than drinking water sludge
SLUDGE	Sludge disposal or re-cycling	D40	DROUGHT	3	Lower water flow	increasing concentration of toxic compounds in sludge; affecting sludge reuse and/or incineration		Lower water flow increases concentration of toxic compounds in sludge, affecting sludge reuse and/or incineration and leading to waste disposal issues	1	1	1	1	VL	See comment	Unlikely from SESW sources
SITE-WIDE SERVICES	All Site wide Services	D41	DROUGHT	1	Exfoliation cracks in storage basin affecting coatings/seals, clay liner failure	accelerated asset deterioration		Exfoliation cracks in storage basin affect coatings/seals, and cause clay liner failure. Accelerated asset deterioration	1	1	1	1	VL	See comment	SESW do not employ clay liners
WATER RESOURCES	Intake Pumping stations	D9	DROUGHT	3	River levels fall,	reduced reliablity as water sources, reducing security of supply		River levels fall and they become less reliable sources, reducing security of supply	1	1	1	1	VL	3.1 Water Resource Planning	Unlikely to effect SESW. Water abstracted from river due winter months. UKCP09 predicting greater precipitation during winter months

APPENDIX D

COSTS ASSOCIATED WITH PRODUCING THIS REPORT

Sutton and East Surrey Water initialling obtained prices from consultants to produce this report. Due to the costs involved (£25,000) and the lack of funding, it was decided to produce the report in house.

This project was written by the Company's Production Manager, who has responsibility for mitigation measures undertaken by the Company to reduce carbon emissions and energy costs. A review was undertaken by senior management. This was principally performed by the company's Engineering Director who has responsibility for regulatory matters.

It is estimated that this report cost the Company, in direct labour time and incidental expenses, £12,300.